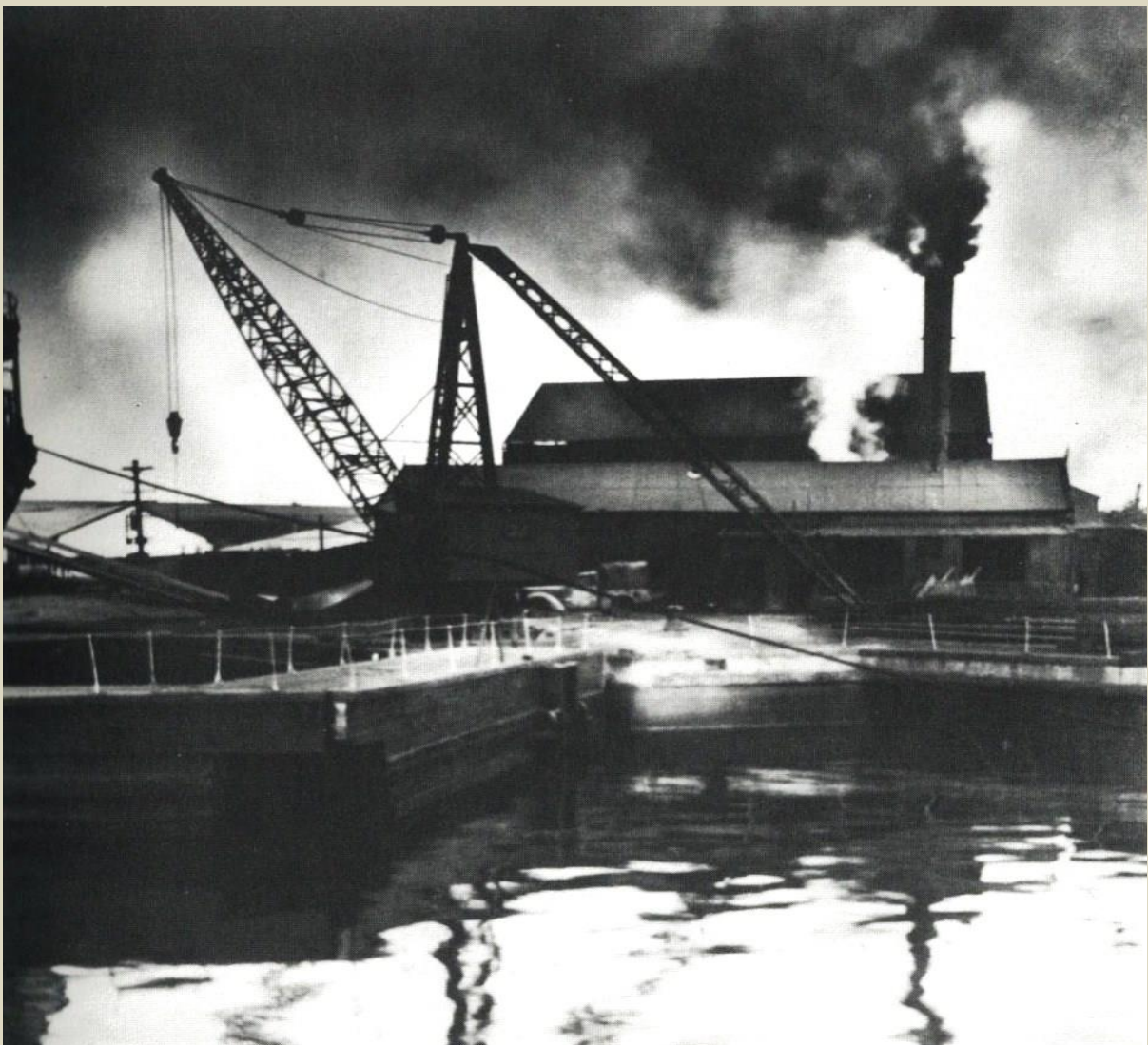


**Engineers Australia
Engineering Heritage Victoria**

Nomination

Engineering Heritage Australia Heritage Recognition Program

DUKE'S & ORR'S DRY DOCK PUMP HOUSE, MELBOURNE, VICTORIA



May 2014

Front Cover Photograph Caption

“The way it was in the 1940s through the eyes of a shipwright.

Melbourne photographer Jack Cato captured the atmosphere of the dry dock in this study of the entrance to Duke’s & Orr’s in the 1940s. The mitre gates are closed and pumping out is well under way”.

Image: Jack Cato. Reproduced at page ix of Arthur E Woodley and Bob Botterill’s book Duke’s & Orr’s Dry Dock. The caption is also taken from the book with thanks to the authors.

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1 Introduction

A Perspective

The dry docks on the South Bank of the Yarra River in the vicinity of Normanby Road were a key part of the infrastructure to support the shipping industry in Melbourne from their establishment in 1868 until closure in 1975.

Important historical events were associated with these dry docks including major shipping accidents, two World Wars and rise to power of the Melbourne Harbour Trust.

The work carried out in these docks was characterised by being dangerous, dirty and often carried out under considerable pressure from ship owners who wanted their ship back in the water as soon as possible. The men (they were all men) who worked in these docks were a tough bunch. They got up early on freezing winter mornings and walked or cycled to the dock. They worked down in the docks, often in cold, filthy sea water for long hours scraping, cleaning, painting and repairing ships. They worked in the confined space under the keels of the ships amongst the keel blocks or on makeshift planking high up on the sides of the ships without any safety equipment except their own know-how. They handled massive baulks of timber with their bare hands.

The men developed relationships which were extremely close amongst themselves, almost always loyal to their employers who treated their skills with respect. They became, however, somewhat notorious to those outside the world of the docks.

They formed themselves into the Federated Ship Painters and Dockers Union (Painters & Dockers) in 1900 and by the time Duke's & Orr's dry dock closed in 1975 they were much feared within the criminal world. The Costigan Royal Commission connected them with 15 murders and 23 attempted murders.

What we do know is that they were loyal to one another, supported one another's families in hard times and worked beyond the normal "call of duty" for their employers. They were strong, tough, cohesive, had a limited respect for "authority" (with good cause) and they kept the wheels of the shipping industry turning in a world which depended on shipping for almost everything. Today none of us would want to do the work which these men did cheerfully year-in and year-out.

If we want to remember anything from the past history of the Yarra River Dry Docks we should remember the men who worked there. Walk around the old dock and the Pump House and you will feel their presence. Be respectful of this important site and the ghosts of the Painters & Dockers will look after you.

What is covered by this Nomination

This nomination tells, in general terms, the story of the several docks in the area. It covers the Pump House and its associated hardware in greater detail.

The Pump House is owned by the Victorian Government which has been very supportive of the restoration and maintenance of the Pump House.

The dock itself is under National Trust of Australia (Victoria) control and it is unlikely that Engineering Heritage Australia would be able to obtain National Trust approval to include the dock in the Heritage Recognition Program.

The History Section (section 3.18) includes the history of the docks but the nomination has attempted to concentrate on the Pump House.

If this emphasis has disrupted the flow of this document, I apologise.

2 Heritage Award Nomination Letter

The Administrator
Engineering Heritage Australia
Engineers Australia
Engineering House
11 National Circuit
BARTON ACT 2600

Name of work: Duke's & Orr's Dry Dock Pump House

The above-mentioned work is nominated for an award under the Engineering Heritage Recognition Program.

Location, including address and map grid reference if a fixed work: Normanby Road, South Melbourne, Victoria 3205. Grid reference: 37°49'00" S, 144°57'40" E

Owner (name & address): Victorian Government, Department of State Development, Business and Innovation, Strategic Projects, Level 36, 121 Exhibition Street, Melbourne, Victoria 3000. Attention Mr Paul O'Dwyer.

The owner has been advised of this nomination and a letter of agreement is attached at Appendix 8.

Access to site: Access to the outside of the Pump House enclosure is in a public place beside the Melbourne Convention Centre. Access inside the enclosure is only available via the Department of State Development, Business and Innovation, Strategic Projects.

Nominating Body: Engineering Heritage Victoria

**Owen Peake
Chair
Engineering Heritage Victoria**

Date: 13 May 2014

3 Heritage Assessment

3.1 Item Name: Duke's & Orr's Dry Dock Pump House

3.2 Other/Former Names: Duke's Dock

3.3 Location: Normanby Road, South Melbourne, Victoria 3205.
Grid reference: 37°49'00" S, 144°57'40" E

3.4 Address: As above

3.5 Suburb/Nearest Town: Melbourne

3.6 State: Victoria

3.7 Local Govt. Area: City of Melbourne

3.8 Owner: Victorian Government, Department of State Development, Business and Innovation, Strategic Projects, Level 36, 121 Exhibition Street, Melbourne, Victoria 3000. Attention Mr Paul O'Dwyer.

3.9 Current Use: Heritage Conservation site

3.10 Former Use: Steam Pump House for dewatering of the adjacent Duke's & Orr's Dry Dock.

3.11 Designer of machinery: Robison Brothers, South Melbourne

3.12 Maker/Builder of machinery: Robison Brothers, South Melbourne

3.13 Year Started: 1901 (rebuilding commenced)

3.14 Year Completed: 1904 (rebuilding completed)

3.15 Physical Description: The Pump House is constructed in a light timber framed building clad with corrugated iron. In recent times the Pump House has been surrounded by a modern steel and glass structure which is part of the Melbourne Convention Centre structure. The machinery consists of a single steam engine coupled to two centrifugal pumps, one mounted at each end of the crankshaft. The engine is an inverted vertical duplex tandem compound machine ¹ supplied with steam at 190 psi (1310 kPa).

¹ This technical designation will be familiar to those fluent in stationary steam terminology. The meaning is as follows: Inverted signifies that the steam cylinders are located above the crankshaft; Duplex signifies that there are two identical halves to the complete engine, some might regard this as two coupled engines; Tandem signifies that the high and low pressure cylinders of each half of the engine are located co-axially one above the other, in this case the high pressure cylinder is at the top; Compound signifies that the steam from the boilers is expanded in two cylinders one after the other, the steam first enters the high pressure cylinder and then flows to the low pressure cylinder before being exhausted to atmosphere.

Adjacent to the Pump House was a Boiler House containing two under-fired multi-tubular boilers also manufactured by Robison Brothers. The Boiler House has now been demolished and the boilers are enclosed only by the new structure built at the time of construction of the Convention Centre. As part of these modifications the steel stack has been cut off leaving only a stump.

The pumping engine is in a deep brick pump pit (dry well). Water is drawn from a concrete tunnel beneath the pump pit which communicated with the bottom of the c1904 enlarged dry dock ². Discharge is upwards and to the side of the Pump House with discharge pipes connecting to the Yarra River.

Most major features of the Pump House are complete except as follows:

- The steel stack from the boilers has been cut off at the top of the boiler enclosure
- The original boiler feed pump is missing.
- The original building has been sectioned to allow visitors to see inside the building through the glass walls of the modern enclosure.

Pump Priming and Ancillary Pumps ³

At the commencement of the dry dock dewatering the volutes of the main steam-driven centrifugal pumps would be water filled due to the standing water level in the dock and thus pumping out would only require turning on the steam supply to the engine. It is understood however that pumping would sometimes be suspended when the dock water level had fallen sufficiently to allow men to start cleaning the hull of a docked vessel from floating punts. Resuming pumping out under these circumstances may have required priming of the main pumps to remove accumulated air from the upper part of their volute casings consequent of the then reduced water level in the dock. Steam operated venturi type ejectors were provided on the delivery pipes close to each pump for this purpose. One ejector is still in-situ although the steam supply and drain piping has been removed.

In addition to the main steam engine driven pumps, the c1904 installation included two horizontal electric motor driven auxiliary pumps. It is believed that these pumps were used to periodically remove leakage water into the dock through the mitre gates and seepage through the dock walls following the initial pump out by the main pumps whilst work continued on the dry docked vessel. The east auxiliary pump suction connects directly into the tunnel beneath the pump pit whilst the west auxiliary pump suction pipe is incorporated inside the suction pipe of the west main pump. The reason for the latter complication is unclear. The two auxiliary pumps remain piped up in-situ although their electric motors have been removed. At some later stage, an electrically driven Nash wet-type vacuum pump has been added along with flexible piping and manual valves for priming of the auxiliary pumps, if found necessary. It remains in-situ mounted on a shelf on the north wall of the pump pit.

² The pump pit was measured by Miles Pierce at 12.7 m x 6.1 m x 5.5 m deep on 21 January 2014.

³ Notes from Miles Pierce, 27 February 2014.

Other Ancillary Steam Plant ⁴

A steam operated winch was originally located on the north side of the Pump House to assist with moving the heavy wooden mitre gates of the dry dock into position and/or returning them to their dockside storage niches after use. The winch is no longer on site but is preserved at the Melbourne Steam Traction Engine Club Inc site at Scoresby.

3.16 Physical Condition: The general physical condition of the Pump House is good considering its age of approximately 110 years. The following aspects are of note:

- The boilers are long disused and are unlikely to ever be recommissioned
- The pump pit has been subject to flooding in recent years and this has caused considerable damage to the lower end of the engine roughly up to the crossheads
- The engine was overhauled and placed back in serviceable condition some years ago. The top end of the engine is still in good condition.
- Some external pipe-work and fittings have been removed. Some of this material is in storage on site and could be restored in its correct position.
- There is considerable termite damage to timber within the building. This should be treated to minimise continuing deterioration and some areas require repair.
- Cleaning of the lower part of the pump pit, pipe-work and the engine is currently in progress by volunteers.

3.17 Modifications and Dates

This section will only deal with changes after the major refit and extension of the dry dock completed in 1904. The following extract summarises the starting point for the dry dock in 1904:

“The enlarged dock opened in March 1904 and, as reported in the *Argus*, the first vessel to be floated in was Archibald Currie’s *Darius* [3295 tons (3348 tonne), 340 ft (104 m) long] on 28 March 1904. It was the first time she had docked in the Yarra” ⁵.

The following modifications were carried out ⁶:

- June 1908. Six electric arc lamps were installed in the dock to facilitate night working on ships.
- January 1923. The Yarra flooded and caused the wooden floor of Duke’s Dock to blow out. Work started to repair the dock behind a specially constructed coffer dam however in August of the same year there was a further flood which found a weakness in the eastern side of the dock which washed out and bypassed the coffer dam. After this second flooding the repair work continued until April 1926 when the dock went back into service.

⁴ Ibid

⁵ Arthur E Woodley and Bob Botterill, *Duke’s & Orr’s Dry Dock*, 1985, page 54.

⁶ Arthur E Woodley and Bob Botterill, *Duke’s & Orr’s Dry Dock*, pp55-62.

- April 1925. Plans were drawn up to replace the floor and parts of the walls with concrete. The concrete floor did not proceed at this time however concrete abutments for the abutment and walls and sills, back as far as the pump inlet, were constructed.
- May 1932. Orr's Dock closed due to the downturn in business with the Great Depression in full swing. This left Duke's Dock as the only dry dock still operating in the Yarra.
- July 1935. A further blow out occurred in Duke's Dock (by this time normally referred to as Duke's & Orr's Dry Dock). This time the floor was replaced with reinforced concrete 4'6" deep and the dock went back into service in November 1935. Whilst this work was being carried out the dock was extended right up to Normanby Road effectively lengthening it to 527 feet (161 m). The new floor enabled heavier ships to be accommodated in the dock. For instance the Shell tanker *Clam* [7404 tons (7522 tonne)] was the first ocean-going tanker to use the dock when it docked for rudder repairs in January 1937.
- Beginning of 1936. An electric crane was installed with a 90 foot (27 m) high jib and a load capacity of 15 tons (15.24 tonnes) at 50 feet (15 m) radius.

The dock remained very busy during and immediately after World War II however the late 1950s saw the end of coastal shipping trade in Australia and international ships became too large to be accommodated in the dock. The dock could not be extended further because Normanby Road prevented extension to the south-east and the river prevented extension to the north- west. The dock closed as a commercial operation in August 1975.

Following closure the dock became the home of the barque *Polly Woodside* and the Melbourne Exhibition and Melbourne Convention Centres were built on the site. The following changes occurred:

- Feb 1996. Melbourne Exhibition Centre opened with a floor area of 30,000 square metres. This building is known locally as "Jeff's Shed" after the Victorian Premier of the time Jeff Kennett ⁷. The dock was reduced in length from the south-east to allow the building of the Melbourne Exhibition Centre ⁸.
- 2009. The dock was refitted and made shallower including the fitting of a new caisson in place of the old wooden mitre gates. At the same time the Pump House was enclosed in a glass building adjacent to the Melbourne Convention Centre and parts of the original timber-framed building were removed to allow visitors to see inside the building ⁹.

⁷ Kennett was Premier from October 1992 to October 1999. Wikipedia, downloaded 27 January 2014.

⁸ Wikipedia, Melbourne Convention Exhibition Centre, version 7 January 2014, downloaded, 27 January 2014.

⁹ Wikipedia, Melbourne Convention Exhibition Centre, version 7 January 2014, downloaded, 27 January 2014.

3.18 Historical Notes:

The first dry dock was Wright & Orr's Old completed in 1868. Captain John Hughes and Captain William Sinnott had obtained a 7 year lease of Crown Lands on the south side of the Yarra River just below Clarendon Street. Here they built a graving dock which was completed by November 1868. The dock was 250 feet (76 m) long, 55 feet (17 m) wide at the top and 40 feet (12 m) at the bottom with 16 feet (5 m) depth of water in the dock and 13.25 feet (4 m) depth over the sill at ordinary tides. The pumping machinery was manufactured by William Wright of Melbourne and consisted of a 20 inch (508 mm) centrifugal pump capable of raising 5000 gallons per minute (66,000 L/s). The details of the drive for the pump are not known however it will have been a steam engine of some kind. This machinery could empty the dock in 2½ hours.

In December 1871 Hughes and Sinnott sold out to Wright, Orr and Company, whose partners were Robert Alexander Wright, Charles Frederick Orr and George Sampson Duke. This firm traded as the Melbourne Dock Company until c1881.

The partnership changed in 1874 when George Duke left to set up his own dock company. His place in the partnership was taken by John Flett ¹⁰.

¹⁰ Arthur E Woodley and Bob Botterill, *Duke's & Orr's Dry Dock*, 1985, pp39-41.



“Aerial view of the River Yarra looking upstream on 29 January 1925, clearly showing the location of the dry docks in relation to the river wharves and the City of Melbourne. Duke’s Dock¹¹ is still under repair, with timber coffer dam across the entrance while Huddart Parker’s SS Goulburn (2367 tons) is in Orr’s Dock”.

Image: Original source not known. Reproduced at page viii of Arthur E Woodley and Bob Botterill’s book Duke’s & Orr’s Dry Dock. The caption is also taken from the book with thanks to the authors although only part of it is reproduced here.

In the 1870s widening of the river and the construction of wharves commenced in the area. This marked the beginning of severe conflict between the Melbourne Harbour Trust and the dock owners. On 1 July 1876 Wright, Orr & Co obtained a lease on additional land to the south of their existing dock on which to build a new dock however they were not prepared to vacate the old dock as they had a valid lease for it.

This led to a bizarre series of confrontations where the Melbourne Harbour Trust blockaded the Wright & Orr Dock with their tug *Warhawk*. Wright & Orr’s men responded vigorously. The dock gate was lowered to the riverbed to enable the barque *Souvenir* to leave the dock and the Harbour Trust then scuttled a punt filled with mud on top of the gate to prevent it being raised. The warfare raged on during the month of November 1878. The Melbourne

¹¹ Dukes Dock is at right centre in this image.

Harbour Trust threatened to use explosives to force their hand until the police intervened. The Melbourne Harbour Trust managed to drive nine piles into the river bed in front of the entrance to the dock, effectively putting it out of use.

After the incident subsided written exchanges continued. Over a year later Wright, Orr & Co was compensated by the Harbour Trust by the payment of £5000 and the company gave up the dock allowing the river to be widened ¹².

Meanwhile in about August 1878 the new dock, called Wright & Orr's New Dock, was completed. The dock was 330 feet (101 m) long, 60 feet (18 m) wide at the top and 46 feet (14 m) at the bottom with 17 feet (5 m) depth of water in the dock and 14.5 feet (4.4 m) depth over the sill at low water. The pumping machinery was manufactured by Robison Brothers of South Melbourne and consisted of two engines with 12 inch (305 mm) diameter cylinders supplied with steam at 75 psi (517 kPa) driving centrifugal pumps. These engines operated at 76 rpm and pumped at 50,000 gallons per minute (660,000 L/s) which could empty the dock in one hour. The first ship to be docked was the barque *Cadzow Forest* of 1116 tons (1134 tonnes) on 14 August 1878.

In March 1879 the Melbourne Harbour Trust tug *Warhawk* was back in the area again. This time as a customer! The tug was apparently allowed to enter the dock, despite its war-like actions previously and apparently came to no harm whilst in the care of the dock men ¹³.

When George Duke left Wright, Orr & Co in 1874 he obtained a seven year lease to build a dock further south again but immediately adjacent to Wright & Orr's New Dock. The dock was 310 feet (94.4 m) long, 40 feet (18.3 m) wide at the gate and 54 feet (16.5 m) at the middle with 14 feet (4.3 m) minimum depth. This dock, like the two earlier ones, was timber lined and had timber gates. The machinery was manufactured by Fulton & Co Foundry, Yarra Bank, was of 35 horsepower (26 kW) but capable of working up to 90 horsepower (67 kW). This machinery could empty the dock in less than two hours. The dock was completed in March 1875.

Again there was conflict with the Melbourne Harbour Trust but in this case no warfare. Duke negotiated for a lease on further land to enable the dock to be extended further away from the river whilst the Harbour Trust resumed land at the front of the dock. Duke modified the dock and excavated a further 300 feet (91.5 m) at the south-eastern end and created a double dock with an intermediate gate enabling two ships to be docked at once.

By 1881 the Harbour Trust was again repudiating its lease and further restricting Duke's operations. Duke claimed compensation, was refused and took the matter to arbitration resulting in the Harbour Trust having to pay him £6250 (\$12,500) in compensation in October 1882.

The modifications to the dock to meet the Harbour Trust requirements were completed by the end of 1883. The dock remained in this form, shortened to 480 feet (146 m) until the major works early in the 20th century.

¹² Arthur E Woodley and Bob Botterill, *Duke's & Orr's Dry Dock*, 1985, pp 41-43.

¹³ *Ibid*, page 43.

At this time the pumping machinery was moved to the north side of the dock but it is not clear what modifications were made. There seems to have been an upgrade as the plant was now described as 145 horsepower (108 kW) and could empty the double dock in 75 minutes ¹⁴.

At about the turn of the century it was apparent to all concerned that larger graving docks were required. The leases of both existing docks had expired and both companies submitted plans to the government for expansion of their facilities. The government was of the view that capacity needed to be increased to accommodate ships up to 6000 tons (6096 tonnes) and docks should be a minimum of 450 feet (137 m) long ¹⁵.

Reconstruction of Duke's Dock started in 1901 and was completed in 1904 for a sum of £43,000 (\$86,000). Almost all the construction of the dock was timber with a mixture of redgum, bluegum, grey box and ironbark. Floor planking (under-layer) was 18 x 10 inch bluegum whilst the working surface was 12 x 4 inch (305 x 102 mm) redgum. Individual lengths of timber included two baulks of grey box 45 feet (13.7) long with a section of 2 feet (610 mm) square. The prodigious quantities of timber used are almost unimaginable today but at that time such quantities of fine, strong timber was readily available.

At this time the machinery was upgraded to the plant currently in place. This was supplied by Robison Bros & Co of South Melbourne and included moving the machinery from the northern side of the dock to its present position south of the dock.

The engine consisted of an inverted vertical duplex tandem compound¹⁶ engine driving a centrifugal pump from each end of the crankshaft. The HP cylinders are uppermost and the engine is fitted with piston valves. Two boilers also made by Robison Bros & Co delivered steam at 190 psi (1310 kPa). The engine was reputedly capable of pumping 5.6 million gallons (21.2 ML) of water in the dock in one hour. The plant was reputedly twice as large as any other docking plant in Australia ¹⁷.

The dock was 520 feet (158.5 m) long, 71 feet (21.6 m) wide at the top of the gate 61 feet (18.6 m) at the bottom of the gate. Depth was 23.5 feet (7.2 m) over the sill on ordinary spring high water and 20 feet (6.1 m) at low water. This dock, like the two earlier ones, was timber lined and had timber mitre gates.

The first vessel to be docked was the 3295 ton (3348 tonne), 340 feet (103.6 m) long SS *Darius* on 28 March 1904.

Wright, Orr & Co closed their dock in 1907 to reconstruct it. The dock reopened in 1909 ¹⁸.

In 1905 the Williamstown Patent Slipway Co took a 21 year lease over Duke's Dock. From this arrangement the Duke's Dock & Engineering Company was formed which operated the dock from 1906 to 1910. Business was brisk during this period and agents around the world

¹⁴ Arthur E Woodley and Bob Botterill, *Duke's & Orr's Dry Dock*, 1985, pp45-46.

¹⁵ Arthur E Woodley and Bob Botterill, *Duke's & Orr's Dry Dock*, 1985, pp 51-54.

¹⁶ See explanation of this terminology on page 8.

¹⁷ *The Age*, Melbourne, 23 August 1907.

¹⁸ Arthur E Woodley and Bob Botterill, *Duke's & Orr's Dry Dock*, 1985, pp54-55.

made arrangements for the dock to be used when ships visited Melbourne. During 1906/07 95 vessels were docked and in 1907/08 116 vessels were docked. Electric lighting was installed in the dock during this time to permit night time working.

During these good years at the beginning of the new century there was competition between the two adjacent docks but there was also strong co-operation. In October 1910 the two docks joined forces and formed the Duke's & Orr's Amalgamated Dry Docks Ltd. Business remained brisk during the World War I period and the early 1920s.

In 1923 serious flooding of the Yarra caused the floor of Duke's Dock to blow out and repairs were still in progress 18 months later. In 1935 Orr's Dock also suffered structural damage, in this case from a weakened wall structure.

The Depression reduced the need for dock facilities and in May 1932 Orr's Dock handled its last ship. The dock was kept available for some time but the structural condition of its walls continued to deteriorate and by 1934 it was abandoned and later filled in.

In 1935 further blowouts of the floor occurred at Duke's Dock and eventually they replaced the floor with a reinforced concrete slab 4.5 feet (1.37 m) thick. This upgrade enabled the dock to take heavier vessels. After the floor was upgraded the Shell tanker *Clam* of 7404 tons (7522 tonnes) was able to use the dock for major rudder repairs in January 1937.

In the years up to World War II business picked up due to the end of the Depression and during the War there was again brisk trade as Australia geared up for the Pacific War. Duke's Dock was now able to take ships up to the 7000-8000 ton (7112 - 8128 tonne) range.

After the War there was another revolution in shipping with the end of the coastal shipping trade and the introduction of much larger more specialised ships. The change to containerised freight and the move to special car carriers are examples of this change. Duke's Dock became too small to meet the needs of the trade. The last ship to use the Duke's Dock before commercial closure in August 1975 was the chemical carrier *Sea Harrier* of 4622 tons (4696 tonne) on charter to ICI Australia. She undocked at 4 pm on 25 July 1975 bringing an end to the graving dock trade in the Yarra River. The graving docks had served the maritime trade in the Yarra River for 100 years and one month ¹⁹.

In 1985 the firm of Duke & Orr Dry Dock Pty Ltd operated a floating dock the *A J Wagglan* downstream of the Charles Grimes Bridge. This dock had a capacity of up to 10,000 tons.

In 1977 the former Duke's & Orr's Dry Dock was ceded to the National Trust of Australia (Victoria) by the Victorian Government to accommodate the barque *Polly Woodside*. The length of the dock was reduced (by about one third its original length) to allow the construction of the Exhibition Centre and still provide ample space for the *Polly Woodside*. The dock was partially filled with 11,000 tons (11176 tonne) of bricks to reduce the volume of water in the dock and help support the wooden walls. The wooden mitre gate was later replaced by a new gate fixed along its bottom edge ²⁰.

¹⁹ Arthur E Woodley and Bob Botterill, *Duke's & Orr's Dry Dock*, 1985, pp 55-62.

²⁰ *Ibid*, page 62.

Later the Pump House including its plant and buildings were incorporated into the Melbourne Convention Centre. A huge glass box was built over the Pump House and sections of the walls of the original building were cut away to allow visitors to see inside the building.

3.19 Heritage Listings:

- **Victorian Heritage Register. Registration number: H1096**

Name: Duke & Orr Dry Dock

Number: H1096

Date: not disclosed

- **National Trust of Australia (Victoria)**

Name: Duke's & Orr's Dry Dock

Number: B2895

Date: not disclosed

- **Heritage Overlay. Melbourne City. Registered number: H0764**

Name: Duke's & Orr's Dry Dock

Number: H0764

Date: not disclosed

4 Assessment of Significance

4.1 Historical Significance: The dry docks on the South Bank of the Yarra River in the vicinity of Normanby Road were a key part of the infrastructure to support the shipping industry in Melbourne from their establishment in 1868 until closure in 1975.

Important historical events were associated with these dry docks including major shipping accidents, two World Wars and rise to power of the Melbourne Harbour Trust.

Refer to Historical Notes at section 3.18

4.2 Historic Individuals or Association:

Individuals associated with the dry dock

Woodley & Botterill provide some sketchy details of the men involved in building the substantial dry dock businesses on the Yarra River. “While Hughes & Sinnott remain rather shadowy figures, we know that Wright, Orr, Flett and Duke were all originally associated with slipways in Williamstown - Wright’s Patent Slip and Duke’s Slip (both of which were situated between the present day Gem and Anne Street Piers)”²¹.

“R A Wright was the son of Robert Wright, proprietor of Wright’s Patent Slip. He arrived in Victoria in 1865 and, when his father died in 1870, took over the business in partnership with C F Orr, who had arrived in Victoria from England in 1852 and had become connected with Wright at Williamstown in 1862. John Flett was foreman in Wright’s Patent Slip in 1872.

In 1872, the centre of Wright & Orr’s operations moved to Melbourne but they continued to operate Wright’s Patent Slip in addition to the Yarra Dry Dock until R A Wright died in November 1900. John Flett appears to have retired from the firm on 30 August 1900.

In addition to the docks and slipways, Wright Orr and Flett owned, from the 1870s to the 1890s, a succession of at least eight sailing vessels ranging in size from the wooden schooner *Woolomai* [151 tons (153 tonne)] to the unusually named ship *The Sir Jamsetjee Family* [1049 tons (1066 tonne)]. The firm of Wright & Orr was also reported to have been a large importer of timber from Puget Sound and to have brought the first load of timber by sea from America - 2 million feet²² in *SS Suffolk*”.

“Incidentally, C F Orr (who died in 1931) was a keen racing man and was for many years Chairman of the Williamstown Racing Club. In this connection his name is still remembered in the ‘C F Orr Stakes’, a prominent event in Melbourne’s racing calendar. He was also a member of the Victorian Marine Board, representing the Port Phillip Pilots.

“George Sampson Duke was born in Skibereen, Ireland in 1831 and was indentured as an apprentice shipwright with John Edwards of St Mary’s, one of the Isles of Scilly, from 1846 to

²¹ Arthur E Woodley and Bob Botterill, *Duke’s & Orr’s Dry Dock*, 1985, page 48.

²² The metric equivalent of this unit is unclear.

1853. He came to Australia in October 1854 and entered the boat building and ship repairing business at Williamstown the same year ²³.

George Duke appears to have given up his Williamstown slipway in about 1873, presumably because of his shift of interest to the Yarra and, in the same year, to have moved his private residence from Williamstown to 2 St Vincent Place, Emerald Hill ²⁴. In about 1885, Duke's firm became known as George Duke & Sons and, later, as G S Duke & Sons. George Duke died in January 1888 and the business was apparently taken over by his sons John George Duke, James Edward Hardy Duke and Augustus Amor Duke in partnership" ²⁵.

Joseph Brady was Chief Engineer for the Melbourne Harbour Trust for a considerable time and was responsible for implementing the recommendations of Sir John Coode. He was a highly respected and versatile engineer of strong character.

A biography of Brady is included at Appendix A2.4.

Organisations associated with the dry dock and Pump House

The Port of Melbourne was not organised under a single body until the formation of the Melbourne Harbour Trust in 1878. A short history of the port can be found at Appendix A2.1.

The Melbourne Harbour Trust (now the Port of Melbourne Authority) was a major player in the development of the Yarra River dry docks. The Harbour Trust was the "landlord" of the docks and issued short term leases for the construction and operation of the docks. In the negotiation of these leases it is clear that the Harbour Trust discussed future trends in ship construction and the types of facilities provided in the dry docks with the owners. This led to increasing the size of the docks over time and increasing the capacity for ship repair facilities, such as cranes in the vicinity of the docks.

The Harbour Trust also had its own agendas which at times caused considerable conflict with the dock owners. The widening of the river and the construction of docks along the river frontage in the vicinity of the dry docks is a case in point. The "Battle of the Docks" in the late 1870s led to armed conflict between the forces of the Harbour Trust and the workers at the docks. Whilst the objectives of the Harbour Trust to improve the useability of the river docks by widening of the river and formalising the dock facilities was laudable their treatment of the dock companies over this issue was overbearing and violent. On the positive side it provided considerable entertainment for locals who paid for tickets to watch the battles.

A short history of the Harbour Trust is at Appendix A2.2.

The Painters and Dockers Union had its Melbourne office in the yard of Duke's & Orr's Amalgamated Dry Docks Ltd from the creation of the Melbourne Branch in 1916. This was the main union of the men working at the dry docks.

The union had a long history of union activism and during the 1960s and 1970s it acquired a reputation for criminality during a period when the Melbourne docks were a very dangerous

²³ Ibid, pp 48-49.

²⁴ Emerald Hill is now part of South Melbourne around the South Melbourne Town Hall. It is bounded by Park, Dorcas, Clarendon and Cecil Streets. Refer to Emerald Hill Master Plan, City of Port Phillip, March 2012.

²⁵ Arthur E Woodley and Bob Botterill, Duke's & Orr's Dry Dock, 1985, page 49.

place. “A Royal Commission would later identify 15 murders, 23 attempted killings and dozens of other violent incidents linked to union crimes and power struggles” ²⁶.

4.3 Creative or Technical Achievement of the Pump House:

The dock dewatering system at Duke’s & Orr’s Dry Dock followed standard practice for its purpose in most respects. Steam-driven pumping plant incorporating centrifugal pumps was employed.

However the sheer size of this pumping plant made it unusual. After the 1901-04 upgrade a very large steam engine was provided, capable of dewatering the large dock in about one hour ²⁷. The installation was claimed to be ‘the biggest centrifugal pumps ever made south of the line’ ²⁸. The configuration of this engine was unusual for a dry dock pumping engine. Unlike steam engines driving large factories or mills or engines in steam ships, which operated almost continuously and were therefore usually designed for maximum fuel efficiency, dock dewatering engine were inherently operated intermittently - only when the dock had to be emptied. This usually led to these engines being robust but less efficient, typically using single expansion and slide valves.

The Robison Brothers engine would have served well as a ships engine. It was a compound and was fitted with piston valves allowing use of higher pressure steam and, if required, superheated steam. This was a very fine engine in its class at that time of history. Even today, with the benefit of longer hindsight, this engine was unusually sophisticated in its construction.

4.4 Research Potential of the dry dock and Pump House:

The site and the subject has been extensively recorded and significant archives remain ²⁹.

Nevertheless a number of aspects are unclear and could be subject to further research:

- No plans of the Pump House upgrade in 1901-04 have been found to date. Recent work in trying to find the source of periodic flooding of the pump pit have been frustrated by a lack of drawings of the below-ground works of the pumping system.
- No photographs of the re construction of the Pump House have been found. Photographs inside the Pump House during its operating phase are also very limited. This makes it harder to understand how the plant was built and operated.
- It is difficult to find much in the way of biographical data of the major players in the various companies over the time of operation. For instance none of the owners has a biography in the Australian Dictionary of Biography. These people

²⁶ Elissa Hunt, The Herald Sun, 18 December 2012.

²⁷ The Age, 23 August 1907.

²⁸ Arthur E Woodley and Bob Botterill, Duke’s & Orr’s Dry Dock, 1985, page 54. The statement is attributed to a publication known as the Leader. The “line” referred to is understood to be the Equator.

²⁹ University of Melbourne Archives has a collection of Duke’s & Orr’s Amalgamated Dry Dock Limited records.

were significant players in the shipping industry in Melbourne however from a historical perspective they seem to be regarded as “just typical businessmen” and therefore of no great interest. Whilst Woodley & Botterill have done a great job of telling stories of the workers in the docks there is little said about the “bosses”.

4.5 Social significance of the dry dock:

This aspect is perhaps the most interesting aspect of the grubby business of cleaning ships’ bottoms. A dedicated cadre of semi-skilled and skilled workers made the docks work. These workers were a key element in the shipping business. Yet not enough has been said about them.

It might be appropriate here to go back and read the ‘A Perspective’ on page 5.

The workers at these docks, as much as any other group of workers in Australia, epitomised the Australian work ethic - hard work, mateship, acceptance of dangerous working conditions, innovation and resourcefulness (fencing wire and binder twine could fix most problems), good relations with employers, strong family values, limited tolerance of authority (in this case particularly the Melbourne Harbour Trust), drinking beer with mates after work and football (South Melbourne Football Club started in 1874) ³⁰.

4.6 Rarity relating to the dry dock and the Pump House:

The use of steam-driven pumping machinery using centrifugal pumps was quite normal practice from the last quarter of the 19th century until the spread of electricity distribution systems, particularly after the First World War, made electrically-driven pumps more popular.

The first aspect of rarity which distinguishes this dry dock Pump House from others is the high level of preservation of the pumping machinery. It is the only graving dock in Australia with its steam-driven de-watering machinery substantially intact.

The status of other known Australian graving dock de-watering machinery is:

- Wright & Orr’s Old Dock (adjacent to the Duke’s & Orr’s Dock)
Built in 1868
Nothing remains of this, the earliest of the Yarra River dry docks. De-watering machinery removed
- Wright & Orr’s New Dock (adjacent to the Duke’s & Orr’s Dock)
Built in 1878
De-watering machinery removed
- Albert Graving Dock, Williamstown, Melbourne ³¹
Completed in 1873 ³²

³⁰ Wikipedia, History of Australian Rules Football, version dated 13 Sept 2013, downloaded 19 January 2014.

³¹ www.emelbourne.net.au/biogs/EM00054b.htm

³² www.onmydoorstep.com.au/heritage-listing/1231/alfred-graving-dock

Dock still in use however steam-driven de-watering machinery has been removed ³³.

- Captain Cook Graving Dock, Garden Island, Sydney
This dock was built during World War II, completed in 1944.
Dock was always equipped with electric de-watering pumps.
- Fitzroy Graving Dock, Cockatoo Island, Sydney
This dock was completed in 1857
The dock was dewatered by DC electric motor-driven mixed or axial flow type pumps from 1918 when the power house was built ^{34 35}.
- Sutherland Dock, Cockatoo Island, Sydney
This dock was completed in 1890
The dock was dewatered by DC electric motor-driven mixed or axial flow type pumps from 1918 when the power house was built ³⁶.
- Woolwich Dock, Sydney
Completed in 1901
The de-watering machinery has apparently been removed ³⁷.
- South Brisbane Dry Dock, Brisbane
Now the site of the Queensland Maritime Museum
Completed in 1881³⁸
The dock was converted to electrically driven pumps (using the original pumps) in 1923.
The Pump House is intact with the pumps and some parts of the two steam engines still in place. The boiler installation is still in place.

³³ The dock is listed by the National Trust of Australia (Victoria) as Registered Number B2896. The Statement of Significance states: "The original steam pumps are no longer at the site and the dock capstans have been removed although one is believed to be preserved near the Ferguson Street Pier".

³⁴ Department of Environment, Australian Heritage Database, Sutherland Dock, Cockatoo Island, NSW, Australia, Place ID 105260, Listed 22/6/2004, Description, History, paragraph 5, "....A new pump house on the west of the island was built for the dock, and this was also used for Fitzroy Dock."

³⁵ The Story of Cockatoo Island, Sydney Harbour Federation Trust, 2004, page 24.

³⁶ Department of Environment, Australian Heritage Database, Sutherland Dock, Cockatoo Island, NSW, Australia, Place ID 105260, Listed 22/6/2004, Description, History, paragraph 5, "....A new pump house on the west of the island was built for the dock, and this was also used for Fitzroy Dock."

³⁷ www.woolwichdock.com/history.html, History 1898-1958 paragraph 3, "A pump house was brought out in parts from England to operate the dock", paragraph 2, "During this period the three oldest buildings on the site were demolished: the relocated Atlas boiler shop, the pump house and an old galvanised iron shed".

³⁸ www.brisbanehistory.com/gravingdock.html

- **Randell Dry Dock, Mannum, South Australia**
Built, using a wooden floating dock as the basis for a fixed graving dock. Completed in 1876. This is the only graving dock on the Murray /Darling River system. De-watering was carried out using a single cylinder beam engine driving a centrifugal pump. The engine has survived and has recently been fully restored by the Mannum Dock Museum of River History however it is no longer in its original location adjacent to the dry dock ^{39 40}.

The locally manufactured inverted vertical twin tandem compound pumping engine is the only steam engine of this configuration known to exist in Australia and the only one known to have been manufactured locally. This gives the preservation of this engine particular importance because of its rarity.

4.7 Representativeness of the Pump House pumping machinery:

Although the pumping machinery at Duke's & Orr's Dry Dock was larger than typical machinery of its time it was typical of de-watering machinery used for graving docks during the 19th and early 20th centuries.

Inspection of this machinery would provide the viewer with a representative picture of the methods used elsewhere.

4.8 Integrity/Intactness of the Pump House:

Refer also to paragraph 3.16 above.

Except for a few minor details the machinery is intact and, in fact could be returned to service, with considerable effort, if required.

Consideration has been given to returning the engine to operating condition and running it on compressed air to demonstrate its operation. This approach recognises that the boilers would most likely require replacement to return the plant to operation and the fact that the Pump House incorporated a large steam-driven air compressor for ship repair work during its time in operation although this compressor has now gone. It would be desirable to remove the couplings to the pumps and allow the engine to run without load.

Another option is to install an electrical drive to the barring gear worm wheel fitted to the eastern end of the crankshaft.

The current volunteer work on the Pump House is emphasising cleaning and the return of the general appearance of the Pump House to its condition when in operation. This particularly relates to the replacement or reconstruction where parts have been permanently lost, of minor parts of the engine and other equipment.

Returning the engine to demonstration operation is a longer term plan beyond the current resources of the present volunteer team.

³⁹ Nigel Ridgway, International Stationary Steam Engine Society (ISSES), Bulletin IB26.1, John Key Beam Engine, 2004/5, pp25-26.

⁴⁰ John Norris, John Key Beam Engine, Mannum, South Australia, paper submitted but not yet published in the International Stationary Steam Engine Society (ISSES), Bulletin, paper submitted November 2013.

5 Statement of Significance:

5.1 National Trust of Australia (Victoria). Registration number: B2895 ⁴¹

The former Duke's & Orr's Dry Dock is of historical significance at a State Level as one of the few surviving relics of a once extensive ship building and repair industry that extended along the Yarra banks in South Melbourne for 3 miles (4.8km) below the Yarra Falls or Queen Street Bridge. At the time of its closure in August 1975, Duke's & Orr's Dry Dock was the oldest and longest operating privately-owned dry dock in Victoria, having been in almost continuous operation for one hundred years.

Duke's & Orr's Dry Dock is also of technological (Scientific) significance at a State level as the last timber-walled dry dock to operate anywhere in Australia and because of its unique locally-built steam pumping plant. This plant included the oldest known surviving installation of Victorian-built underfired multi-tubular boilers in the metropolitan area and the only extant pair of Victorian-built tandem compound vertical steam pumping engines.

Associated timber, corrugated iron and fibro-cement buildings which once formed part of the dock complex, although of only local architectural significance in their own right, provide an important and authentic aspect of the dock's context, contributing visual reminders of the way the precinct looked during its heyday of the 1900s-1940s. Likewise, the cobbled bluestone laneways that form Tyne Street and Phayer Street provide a significant contributing historic aspect of the precinct.

5.2 Heritage Victoria, Victorian Heritage Register. Registration number: H1096 ⁴²

What is significant?

Duke and Orr's Dry Dock is a large timber lined dock which currently houses the historic barque Polly Woodside. It was built in 1875 and was largely reconstructed in 1901 with a new pump house, plant and machinery. The dock, gates, ⁴³ machinery and pump house are largely intact, although the basin of the dock has been partially filled and reduced in length. The dock is now approximately 107m long, 24m wide and 7m deep.

How is it significant?

Duke and Orr's Dry Dock is of historical and scientific (technical) significance to the State of Victoria.

⁴¹ <http://www.dpcd.vic.gov.au/heritage/victorian-heritage-register> , Victorian Heritage Database.

⁴² Ibid.

⁴³ The gates are no longer intact.

Why is it significant?

Duke and Orr's Dry Dock is of historical significance as one of the few surviving relics of a once extensive ship building and repair industry that stretched along the south bank of the Yarra River for five kilometres below the Queen Street Bridge. Its location is a reminder of the once close proximity between the CBD and its port facilities, a proximity that was interrupted by changed cargo handling methods and larger ships. At the time of its closure in August 1975 it was the oldest and longest operating privately-owned dry dock in Victoria, having been in almost continuous operation for one hundred years. Associated buildings provide an important and authentic aspect of the dock's historical context as do the cobbled bluestone laneways that formed Tyne Street and Phayer Street which contribute a significant historical aspect to the precinct.

Duke and Orr's Dry Dock is of scientific (technical) significance as the last timber walled dry dock to operate in Australia and because of its unique steam plant which includes the oldest known surviving installation of Victorian-built under-fired tubular boilers in the metropolitan area, and the only extant pair of Victorian-built tandem compound vertical steam pumping engines.

6 Area of Significance:

State Significance

7 Interpretation Plan

7.1 General Approach

The ceremony is currently planned to coincide with Engineers Australia's National Convention which will be held at the Melbourne Convention Centre between **Monday 24 and Friday 28 November 2014**. The exact date and time of the ceremony will depend on planning for the National Convention. The ceremony should be held in the vicinity of the Pump House.

At the time of writing this nomination the interpretation of the site is very poor. However the Department of State Development, Business and Innovation are planning three new interpretation panels. EHV has been in consultation with the Department on the content and presentation of the panels for some time and it is hoped that these will be erected before the proposed ceremony date.

If this is achieved EHV will co-ordinate its interpretation to complement the panels provided by the Department.

The fall back position for EHV will be a standard panel as detailed below.

7.2 General Attributes of the Interpretation Panel:

- 1) A title **"Duke's & Orr's Dry Dock Pump House"**
- 2) A sub title: **"Last complete dry dock steam pumping machinery in Australia"**
- 3) Logos of Engineers Australia and Victorian Government to be incorporated.
- 4) A small size representation of the EHA marker plate
- 5) The date and other details of the marking ceremony.
- 6) Text should be 24 point Arial Bold
- 7) Maximum text should be 500 words
- 8) A map of the dry docks in the Yarra River
- 9) Historic photographs preferably not ones used on the other interpretation panels at the site

7.3 The Interpretation Panel:

- 1) Size to be nominally 600 mm high by 1200 mm wide.
- 2) The panel to be constructed of vitreous enamel-on-steel plate or vinyl film-on-aluminium with flanges as per drawing at Appendix 7. The panel configuration will be changed slightly to allow for the custom mounting arrangement. The flanges will be increased from 40 mm to 50 mm and 55 mm wide slots will be cut into the lower flange to accommodate the aluminium mounting members. Fixing holes will be provided in the side flanges instead of the top and bottom flanges.
- 3) The panel to be mounted on an aluminium frame which will be placed within the modern enclosure of the Pump House but outside the walls of the original Pump House

building. The exact location will be decided after the three new interpretation panels have been placed. The proposed mounting frame arrangement is shown at Appendix 7.

7.4 Possible Interpretation themes for Interpretation Panel

This will be a standard panel with the following three themes:

- History of Duke's & Orr's Dry Dock
- Robison Brothers pumping engine
- Important Associations: the Melbourne Harbour Trust and the Federated Ships Painters and Dockers Union

7.5 Preliminary Text Block for Interpretation Panel

7.5.1 History of Duke's & Orr's Dry Dock

The Duke's & Orr's Dry Dock was an important facility for the docks of the Yarra River providing docking facilities for routine maintenance and repair of ships. The docks were primarily used by commercial shipping although there are some records of war ships using the dock. They provided services for over one hundred years from 1868 to 1975.

Little is known of the diligent businessmen who operated the dry docks. They kept very much to themselves and ran a business critical to the efficient operation of the Port of Melbourne, always ensuring that ships which entered their dock were serviced and released back to their owners in the shortest possible time.

118 words

7.5.2 Robison Brothers pumping engine

The pumping engine for de-watering the dock was replaced in 1901-1904 with a larger plant which has been preserved in this Pump House. At the time of its installation it was claimed to be the largest centrifugal pumping installation in the southern hemisphere and capable of pumping out the dock in about one hour.

The steam engine, pumps and boilers were built by Robison Brothers of South Melbourne. Their factory was located a few hundred metres away in Normanby Road.

84 words

7.5.3 Important Associations

Melbourne Harbour Trust

The Harbour Trust was formed in 1877 to coordinate and manage dock facilities in the Port of Melbourne. Following the Gold Rush the port had expanded to be the largest in the nation. It remains the largest container port in Australia.

The Harbour Trust had a stormy relationship with the dry dock owners which at times led to violence. However the dry docks provided an essential service to the port.

The Chief Engineer of the Harbour Trust during the period of rapid development of the docks was Joseph Brady, a versatile and respected engineer. It was Brady who interpreted the recommendations of English consultant Sir John Coode and re-shaped the Lower Yarra by building the Coode Canal and Victoria Harbour. His visionary engineering enabled these facilities to remain fit-for-purpose for over a century.

Federated Ships Painters and Dockers Union

The men who worked at the dock experienced appalling working conditions which were invariably wet, exhausting and dangerous. They were tough men but fiercely loyal to their mates, the dock owners and their families. Many were members of the notorious Federated Ship Painters and Dockers Union which had its headquarters at the Duke's & Orr's site.

They kept the wheels of the shipping industry turning in a world which depended on shipping for almost everything. Today none of us would want to do the work which these men did cheerfully year-in and year-out.

237 words

Total Words = 439

8 References:

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Appendix 1: Images with Captions

A1.1 Historic Images



Duke's & Orr's Dry Dock. The gate sill with the dock chamber beyond. This image is not dated however the large vertical objects in the background are the mitre gates to close the dock. This type of gate was first incorporated during the 1901-04 reconstruction hence it is likely that this image was taken at that time.

Image: From the Duke's and Orr's Amalgamated Dry Docks Ltd collection, no date, item 1972.0042.0110, unit 59, University of Melbourne Archives



"The steamer '*Edina*' in Duke and Orr's dry dock for repairs, Melbourne, 3 May 1898. The '*Edina*' was built in 1854 and was the oldest working steamship in the world when it was retired in 1938.

Photograph by Thomas Beckett. Part of a collection of glass plate negatives taken by Dr Thomas George Beckett, doctor, pioneering radiologist and amateur photographer between 1891 and 1910. The collection is primarily of Beckett's family, friends, homes, and towns and suburbs where Beckett and his family lived, including Charlton in central Victoria and Northcote & South Yarra, suburbs of Melbourne, Victoria.

At the time this photograph was taken, the '*Edina*' was undergoing repairs to damage caused as a result of a collision with the Union Steamship Company's '*Manawatu*' which occurred on the evening of 27th April 1898 near the Gellibrand Lightship, off Williamstown. As a result of the accident, the smaller wooden-hulled 122 ton '*Manawatu*', outward bound for Devonport with a cargo of 1,000 bags of phosphates, sunk about 100 yards off Breakwater Pier, while the larger iron-hulled '*Edina*', that was inward bound heading from Geelong to Melbourne, was deliberately run ashore near Point Gellibrand reef, where the vessel stuck fast for several days before being recovered. A subsequent Court of Marine Inquiry hearing in May acquitted the pilot Blanchard on a charge of misconduct, but found Captain Forbes of the '*Edina*' guilty of gross misconduct and suspended his certificate for 12 months.

The extensive damage to the '*Edina*' was described in the press as follows: 'On the starboard side, immediately forward of the bridge, the line of the bulwarks show a curve 'inwards,' and 6ft. further, on the gradually increasing turn ends abruptly in a jagged edge of iron. For another 10ft, the whole side of the vessel above the water-line has been swept away, the cause being manifest by the presence of the complete half of a ship's bows bearing the word "*Manawatu*," in large white letters. Behind this piece of timber is one of the heavy iron anchors of the Tasmanian boat, and scattered among the debris is a quantity of its other tackle. The spot where the nose of the *Manawatu* now lies amid a heap of shattered timber and iron was the cabin of the chief engineer, Mr Nolan, and above, the debris there still swings floral almanac, with the words "God Bless Our Home" shining out in gilt letters. But the worst damage of all was done the lower deck, for on gazing with difficulty over the starboard side a hole is to be seen "big enough," as the chief steward remarked "to drive a carriage pair through."

This was the side of the saloon which smashed in, and the whole of the furnishings in that part are wrecked and torn.' (Williamstown Chronicle, 30 April 1898).

Description of Content:

A view from the stern of the single-screw steamer '*Edina*' in Duke & Orr's Dry Dock, South Melbourne, for repairs. The ship's propeller has been removed for repair or replacement. The 'Robur' Tea Warehouse can be seen in the background. A number of men dressed in suits and hats are standing on the dock edge at the right inspecting the vessel. There is a dock worker crouched on a gang plank moving a spar (or long pole) across to the vessel.

Acquisition Information:

Donation from Mrs Joan Hadden"

Image and Text: Museum Victoria



HMAS Ardent in Duke's & Orr's Dry Dock in 1973, two years before the dock ceased commercial operations. ***HMAS Ardent*** was an Attack Class Patrol Boat of the Royal Australian Navy built by Evans Deakin in Brisbane and commissioned on Oct. 26, 1968. She ended her service life as a Sydney-based navigational training vessel until replaced by the private contractor's *Seahorse Mercator* in 1994. ***Ardent*** was sold out of service and taken to Singapore for conversion to a pleasure vessel.

Image: David Menzies, found on Flickr



The Pump House building in 2006 viewed from the north. The lower section to the left is the Pump House with the Boiler House to the right. *Image: Miles Pierce*

A1.2 Modern Images



Modern enclosure of the Duke's & Orr's Pump House adjacent to the Melbourne Convention Centre. *Image: Owen Peake*



Barque Polly Woodside in the Duke's & Orr's Dry Dock.
Image: Owen Peake



Cylinders of the Duke's & Orr's pumping engine. The high pressure cylinders are at the top with the low pressure cylinders partly below the intermediate platform.
Image: Owen Peake



Flooding of the pump pit in August 2010. Water was almost up to the intermediate platform or about 3 m above the floor of the pump pit.

Image: Owen Peake



Top of one of the low pressure cylinders with the rod of the piston valve to the right and the piston rod just visible at left. This part of the engine has not been submerged and is in very good condition. *Image: Owen Peake*



Main pump outlet pipe leading to the river from the intermediate platform. This pipe is about 1 m in diameter. Image: Owen Peake



Crankshaft at the northern end of the engine. From left: 1) crank counterweight, 2) Main Bearing, 3) Eccentric Strap, 4) Barring Gear, 5) Pump Gland (out of view behind worm gear). This area has been submerged. Image: Owen Peake



Main Crosshead of south bank of the engine. This area has been submerged.
Image: Owen Peake



Test plate on boiler. The operating steam pressure of the engines was 190 psi (1310 kPa) so the test pressure was 31% above operating pressure.
Image: Miles Pierce



Top of the boilers. Safety Valves and Main Stop Valves can be seen with the stump of the steel chimney at rear. Spare parts and equipment is now stored in this area.

Image: Miles Pierce



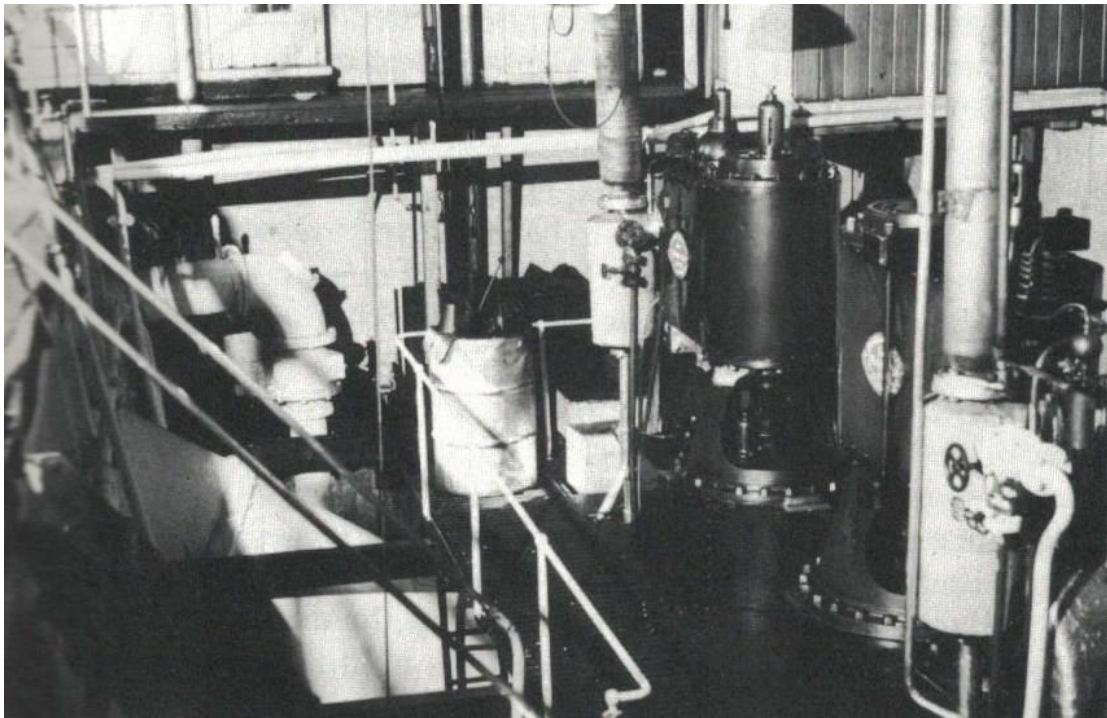
Steam piping to engines above the pump pit at rafter level. Note cylindrical steam trap.

Image: Major Projects Victoria



Looking out of the Pump House with pump pit below and ground level walkway above. Taken following cleanup in 2013. *Image: Owen Peake*

A1.3 Comparative Images



Pumping Engines from Ground Floor early 1970S. At this time the pumps were still in operation. *Image: Woodley & Botterill, 1985.*



Pumping Engines from Ground Floor January 2014 from the same position. Note that the steam pipes are no longer lagged and that the name plates have been removed from the HP cylinders. Minor piping and cylinder lubricators are also missing. *Image: Owen Peake*

Appendix 2: Historic Individuals or Associations

A2.1 Port of Melbourne History ⁴⁴

The Port of Melbourne has extended from Williamstown and Port Melbourne on Hobsons Bay, to the part of the Yarra River known as Queens Wharf, opposite William Street, central Melbourne.

When the *'Enterprise'* carrying settlers from Tasmania, entered the Yarra River in August, 1835, it stopped short of the rocky river bottom which was opposite Market Street. Settlement in that vicinity was commenced, as boats could not be navigated upstream and, within a few hundred metres, drinking water could be fetched from beyond the rocky falls. Within four years a primitive wharf was functioning on the north bank of the river, and a customs house was built between William and Market Streets. Downstream, between Spencer and King Street, private wharves were built, the best known being Coles.

Across Hobsons Bay the township of Williamstown was laid out in April, 1837. A jetty made of boulders was completed in February, 1839. A private pier was built at Sandridge (Port Melbourne), by Wilbraham Liardet in 1839. Both these bayside facilities came about because of the difficulty of navigating the river which, before the construction of the Coode Canal, had an S-shaped course through the West Melbourne swamp lands.

The gold-rush immigration years in the 1850s caused acute congestion of the port. The unloading of goods and passengers was helped, though, by the building of the Melbourne to Hobsons Bay railway and the construction of the Railway Pier (now Station Pier), Port Melbourne. In 1851 the Colonial Architect and Melbourne city's surveyor proposed the cutting of canal across the swamp lands to relieve the congested river. Eight years later the first of four reports recommended the formation of a separate body or harbour trust to manage all the port facilities.

With the support of the Melbourne Chamber of Commerce the Melbourne Harbor Trust was established in 1876 and within three years it had a report from Sir John Coode, an English harbour engineer, recommending the route of a canal, not along the shortest possible route to Hobsons Bay, but cutting off the sharpest loop of the river meander (from approximately today's Appleton Dock to south of where the Maribyrnong River enters the Yarra). The route avoided high velocity currents from Hobsons Bay, and retained the scouring action of both rivers' flows to cut down silt deposition at the river mouth and around Williamstown. The Coode Canal, opened in 1886, 1,800 metres long, 100 metres wide, and eight metres deep, it left Coode Island to its north. The island was joined to West Melbourne as the meander was filled.

Port Melbourne had 38% of the lineal wharves' length, Williamstown 26% and the up-river areas 36%. The up-river Queens wharf area was situated on a naturally wider part of the river, sometimes likened to London's Pool. At various times it had been a

⁴⁴ Only Melbourne, Port of Melbourne History, www.onlymelbourne.com.au/melbourne_details.php?id=4468
Ripefruit Media Company.

quagmire, a receptacle for waste from slaughter yards and discarded tallow, and an unsightly collection of flotsam. Its proximity to Flinders and Spencer Street stations and the Melbourne Fish Market preserved its activity, but by the 1950s the northern side had been substantially filled in for land reclamation. There were also wharves along the south side of the river.

In 1892 the West Melbourne Dock (now the Victoria Dock) was opened, down-stream and immediately west of the Spencer Street railway shunting yards. It contains a swing basin for ships, replacing the one which had been provided on the south side of the river, later to be the Duke and Orr dry dock, west (sic) of the Charles Grimes Bridge. Further west was the South Wharf along the river bank.

Shortly before the opening of the Coode Canal the piers at Williamstown were lengthened, the largest being the Breakwater Pier. There were also minor wharves along the west sides of the Maribyrnong and Yarra Rivers, and the latter were later developed for bulk cargoes.

The spacious Victoria Dock was hampered by a shallow river entry until the Canal was deepened to 8.2 metres in 1917. Meanwhile a second railway pier was built at Port Melbourne in 1914, and named Princes Pier in 1920.

Deep-draught vessels continued to put pressure on the Port's harbour facilities and the construction of the Spencer Street bridge in 1929 effectively closed the Queens wharf area to all but the smallest craft. In anticipation of this a new harbour at the mouth of the Moonee Ponds Creek had been commenced (1929), to become Appleton Dock, and South Wharf was extended west. Williamstown's Nelson Pier was extended in the late 1920s for bulk cargo, particularly wheat. While the excavation and fitting out of Appleton Dock was under way Station Pier was rebuilt in 1930.

Oil wharves were on the west side of the Yarra at Newport, Spotswood and Yarraville. They were later concentrated at Yarraville, for bulk ammonia, sugar, phosphate and soda ash. The Holden Oil Dock is the southern-most facility at Yarraville. There are oil and gas cargo wharves at Williamstown and opposite Holden Dock on Coode Island.

In the 1960s containerized cargo resulted in Swanson Dock being constructed on Hobsons Bay, down-stream from Appleton Dock and Webb Dock, between Princes Pier and the river mouth. Swanson Dock was excavated out of Coode Island and Webb Dock was built by both excavation and land reclamation.

By the end of the 1980s Swanson Dock handled about one-third of the port's total trade, Webb Dock about one-sixth and Victoria Dock the same. Smaller volumes went through Appleton Dock and South Wharf.

The Port of Melbourne was brought under the Melbourne Harbor Trust in 1876, which in 1978 became the Port of Melbourne Authority. It was headquartered in the Harbor Trust building in Market Street, Melbourne, until it moved to its World Trade Centre (1983), west of the Spencer Street Bridge. Opposite the Centre, on the other side of the river is the former Little Dock, with the Melbourne Maritime Museum and the barque "Polly Woodside". The Authority's territory stops at the Spencer Street Bridge. Further up the river the Queens Wharf "Pool" has been filled and the reclaimed land made into Batman Park, after first being a car-park area. Batman Park also extended over the site of the architecturally ornate but ultimately decrepit Melbourne Fish Market. The Park's most prominent structure is the yellow-painted sculpture "Vault", which fortuitously found a better home than its original position in Melbourne's city square.

The Authority's territory occupies most of Coode Island south of Footscray Road, ribbons of foreshore down to Williamstown and around Port Melbourne and a large area around Webb Dock. Webb Dock has a railway line ⁴⁵ to the Spencer Street yards, as do the others. The railway lines to the Williamstown piers, however, have been taken up, and Station Pier lost its railway to a tram passenger service.

A2.2 Melbourne Harbour Trust (MHT) ⁴⁶

The Melbourne Harbor Trust was established in 1877 to operate and improve shipping facility in Melbourne's ports and harbours.

Creation of the MHT

In the 1860s and 70s, agitation for the establishment of a trust on the lines of those on the Thames in London, the Mersey at Liverpool and especially that on the Clyde (which was run by Glasgow's leading merchants), came predominantly from the Melbourne Chamber of Commerce. However, Williamstown and Geelong Interests opposed the measure, while Alfred Clark (Williamstown's Member of Parliament) warned *...if ships were to be taken up the river then 'grass will grow on the piers and streets of Williamstown*. The Trust reflected Melbourne mercantile interests but the new government was hostile towards it.

Prior to its establishment there was little co-ordinated management or development of Melbourne ports facilities, with only some haphazard wharves and jetties constructed along the Yarra River, at Sandridge and at Williamstown. Vessel movements and berthings, navigational aids, and wharfage rates, were previously the responsibility of the Ports and Harbours Branch under the Department of Trade and Customs.

The Trust, as it became known, was only created after several boards of inquiry into means to improve access for shipping to Melbourne and a specific Act of Parliament in 1867. The first election and appointment of fifteen Commissioners, who represented various interests in the Port, was held on 30 March 1877, with a meeting on 11 April 1877 to elect office bearers.

British engineer, Sir John Coode, was commissioned to advise on port improvements. Coode produced a scheme involving a large dock basin, Victoria Dock and straightening the river through a new cut, now known as the Coode Canal. However, the works could not commence until 1883 when a coalition government united the previously opposing groups. Under Coode's Plan, heavily modified by the Trust's own engineer, Joseph Brady, the Yarra was deepened and cleared of obstructions, and the Coode Canal was excavated, opening in 1886, straightening the river's meandering lower course. Excavation of Victoria Dock was underway in 1891, opening in 1896, the Sandridge Lagoon was being filled and the deep-water channel to Port Melbourne was being dredged. Dock construction under the original Harbour Trust scheme continued into the 1920s.

⁴⁵ The railway line to Webb Dock is now derelict with no rail crossing of the river into the South Melbourne/Fishermans Bend side.

⁴⁶ Wikipedia, Melbourne Harbour Trust, 13 October 2013 edition, downloaded 28 January 2014.

By 1927 the Trust was employing more than 1000 men and Melbourne was the eighth largest deep-water port in the British Empire. After 1945 new facilities were developed downstream, including Appleton (1956), Webb (1960) and Swanson (1969) docks, the last being named after Victor Swanson, chairman of the Trust, 1960-72.

Functions

The purpose of the trust was *...to provide for the Regulation, Management and Improvement of the Port of Melbourne and certain portions of the River Yarra and certain portions of the Saltwater River....[including the regulation of the trade of the port with respect to such matters as landing of shipping of merchandise, arrivals and departures of vessels, wharfage rates...management of port facilities, [and] improvements to the port].*

Development and Reconstitution

Two additional Commissioners were appointed on 14 November 1883 and up to 1900 the Melbourne Harbor Trust Commissioners were responsible to the Commissioner of Trade and Customs and afterwards to the Minister for Public Works. There was a major reconstitution of the Trust in 1913 whereby seventeen elected Commissioners were replaced with five Commissioners appointed by the Governor-in-Council. These five included a full-time Chairman and four representatives of ship owners, exporters, importers and primary producers. The Trust also gained responsibility for the railway piers at Port Melbourne and Williamstown from 1 December 1913, bringing all the wharves, piers and jetties within the Port of Melbourne under the one authority. A sixth Commissioner was appointed to represent port workers in 1954, perhaps indicating the growing influence of the Dockworkers Union.

Port of Melbourne Authority

The Harbour trust was reorganised in 1978 to form the Port of Melbourne Authority, in line with modern organizational naming practice around the world, although its functions did not change greatly. It moved from its Market Street head office to the World Trade Centre (Melbourne) in 1983. Subsequent restructuring in 1997 saw the Melbourne Port Corporation take over property and assets, the Victorian Channels Authority berthing responsibilities, and Melbourne Port Services privatised and put out to tender. The Port of Melbourne Corporation was formed on 1 July 2003, taking over the Melbourne Port Corporation, and the Victorian Channels Authority.

Facilities

Maintenance workshops erected in Williamstown.

The Trust operated a series of dredges including:

- *Bunyip* 1879-
- *G. Ward Cole* Iron screw dredging steamer c1890
- *PIONEER* Sand dredge c1940s
- *John Nimmo* 1887-1931
- *Sir William McPherson* 1912-1949
- *Melbourne*
- *D. McLennan* 1925-1949
- *George Kermode* Twin screw Steam bucket dredge 1941-1976
- *Mathew Flinders* Cutter suction Dredge c1960-1985

The North and South Wharves were extended downstream, and in the 1930s-50s Appleton Dock was reconstructed and extended, followed by Swanson Dock, and Webb Dock.

A2.3 Federated Ship Painters and Dockers Union ⁴⁷

The Federated Ship Painters and Dockers Union (FSPDU) was an Australian trade union which existed between 1900 and 1993. It represented labourers in the shipbuilding industry, covering *"mostly work associated with chipping, painting, scrubbing [and] cleaning [ships], working in every size of tanks, cleaning boilers, docking and undocking vessels, and rigging work"*.



Establishment

The Painters and Dockers' Union had its origins in the New South Wales Associated Laborers Union, also known as the Balmain Labourers Union, which was established in Balmain May 1883. The new union was formed to represent all unskilled workers or labourers in the area, but was focussed mainly on shipbuilding and ship repair, the main industry in Balmain. The union gradually grew in stature over the next decade, affiliating with the Trades and Labor Council of Sydney in 1889 and establishing the Balmain Trades and Labor Hall in 1890. The union was involved in the unsuccessful 1890 Maritime Strike. The union was also heavily involved in the formation of the first branch of the Labor Electoral League of New South Wales, the forerunner to the Australian Labor Party, in Balmain in April 1891. The union's finances suffered during the depression of the 1890s and in January 1898 the union's members unanimously voted for its dissolution.

Following the dissolution of the Balmain Labourers Union its members were reorganised along industrial lines, with the broad coverage of unskilled and semi-skilled workers in the shipbuilding industry split mainly between the Federated Ironworkers' Association and the Federated Ship Painters and Dockers' Union of Port Jackson, the latter being formally established in 1900. The union conducted two successful strikes in the same year, establishing closed shop arrangements in the industry. The union soon expanded out of Balmain to represent painters and dockers working throughout Sydney Harbour, growing

⁴⁷ Wikipedia, Federated Ship Painters and Dockers Union of Australia (1916 - 1993), version 25 December 2013, downloaded 28 January 2014.

rapidly from 449 in 1902 to 1954 in 1907. The union achieved its first industrial award in 1903, a collective agreement with employers, registered by consent, before amalgamating with similar unions in other states to form the Federated Ship Painters and Dockers Union of Australia in 1909. The union achieved federal registration in 1916, giving it access to the federal system of arbitration and conciliation courts.

Growth

Working conditions and pay for ship painters and dockers in the early 20th century were poor, with 80 percent of the union's membership in 1939 earning less than the basic wage. Ninety percent of painters and dockers were employed as casuals, under the free selection of labour system. This meant workers had to wait outside shipyards and port workshops, where foremen would choose different men to work each day, depending on the requirements of the employer. The union made significant efforts to regulate this system of hiring, including passing limits on the minimum length of employment and the number of hours workers would wait each day, but with little success.

Conditions changed dramatically during World War II, as increased demand in the shipbuilding industry led to a labour shortage. The membership of the union grew rapidly, increasing in Sydney from 880 in 1939 to 2792 in 1945. During 1945 the union began operating a roster for painters and dockers, dispatching workers to the various employers as needed. This development was resisted by employers, who launched a lockout of all painters and dockers in the Port of Newcastle, but agreement was reached in the Commonwealth Arbitration Court in 1946 allowing the practice to continue.

The roster was operated out of the branch office of the union in each port, which acted as a hiring hall. Members were allocated jobs each morning based on how long they had been waiting for work. Refusal to accept a job meant the member would lose their position in the allocation order. Employers retained the right to determine the number of workers required, and to reject any workers they thought unsuitable.

The dangerous and difficult nature of the work, as well as the small and close-knit nature of the workforce, encouraged strong union organisation amongst the painters and dockers and the FSPDU developed a reputation for militancy. For example, despite only representing 15 percent of the workforce in the shipbuilding and ship repair industry the FSPDU was involved in 40 percent of all industrial disputes between 1975 and 1978. The FSPDU was also notable for being the only union in Australia after 1976 to have more than 5 percent of its members in the shipbuilding and ship repair industry.

Decline

The FSPDU faced a decline in membership during the late 20th century as mechanisation including sandblasting and spray painting and the decline of Australian commercial shipbuilding reduced the number of jobs available. By the late 1970s membership of the union had fallen to approximately 2000, although the union actively defended the work of its members through competition with other unions over coverage, being involved in a high proportion of all demarcation disputes in the shipbuilding industry. As work declined in the industry, employers began to seek the removal of the union roster system, provoking an eleven-week strike at the Garden Island dockyard in Sydney in 1976 and a sixteen-week dispute in Newcastle in 1978. Both disputes ended with the union retaining the right to operate the roster.

Alleged criminality and deregistration

In the 1960s and 1970s the union was alleged to have criminal connections.

In 1980 the union was subject to the Costigan Commission (officially entitled the *Royal Commission on the activities of the Federated Ship Painters and Dockers Union*), enquiring into its involvement with organised crime and tax evasion. This Commission became famous because its investigations led to the airing of allegations of tax evasion and drug trafficking against Kerry Packer, then Australia's richest man.

The union was de-registered in 1993. Despite widespread allegations of criminality, the reason the union was de-registered was because it had less than 1,000 members. After the *Industrial Relations Act 1988* was passed by the Hawke Government unions with less than 1,000 members had to show why, in the public interest, their existence should continue. Whilst the Dockers opposed de-registration on principle it could not advance an argument to continue its existence, taking the Act into account. Before de-registration members of the Dockers had been transferred to what are now the Maritime Union of Australia and the AMWU.

Several prominent former members were involved in the Melbourne gangland killings. Lewis Moran and Graham Kinniburgh were both former members and met on the Melbourne waterfront. Five persons who were members or associated with the Union were connected with the attempted robbery of Trans Australia Airlines Flight 454.

A2.4 Joseph Brady (1828-1908)^{48 49}



Joseph Brady

Joseph Brady was the engineer supervising construction for Cornish and Bruce, especially the Malmsbury Viaduct, Taradale Viaduct, Big Hill Tunnel, and Elphinstone Tunnel⁵⁰. This section of the railway was regarded as the most challenging.

Joseph Brady (1828-1908), civil engineer, was born on 18 August 1828 near Enniskillen, County Fermanagh, Ireland. Under his father in 1842-44 he served on the Title Commutation Survey in England and became proficient in field surveying and draftsmanship. He was then employed as an assistant engineer with Charles B. Vignoles, a past president of the Institution of Civil Engineers, on railway surveys in Kent and Lincolnshire and on the construction of the Skipton, Sedbergh and Lancaster railway. Soon after this was opened in 1850 Brady migrated in the *Argyle* to Sydney, where he became a draftsman with the newly-established Sydney Railway Co.

In January 1851 Brady resigned to carry out surveys and prepare drawings for the Yan Yean water scheme for Melbourne under James Blackburn, the city surveyor. When the work was finished he applied successfully for appointment as assistant engineer with the Sydney Railway Co. on 24 July 1851. He carried out surveys and construction works on the company's railway between Sydney and Parramatta, and had special charge of the surveys and later the construction of the railway from Sydney to the iron-mines at Mittagong Range, near Goulburn. For some time he also acted as chief engineer to the company while carrying out his other duties. Soon after a new chief was appointed, he resigned in 1857 and returned to Victoria.

⁴⁸ Kerr, C. F., 'Brady, Joseph (1828–1908)', Australian Dictionary of Biography, National Centre of Biography, Australian National University, <http://adb.anu.edu.au/biography/brady-joseph-3042/text4449>, accessed 20 May 2012. This article was first published in hardcopy in *Australian Dictionary of Biography*, Volume 3, (MUP), 1969.

⁴⁹ 'Obituary: Joseph Brady', *Minutes of Proceedings of the Institution of Civil Engineers* (London), vol 174, 1908, pp 374-76

⁵⁰ Ken McInnes, email 14 May 2012.

In 1858-63 he was engineer to the Sandhurst (Bendigo) waterworks, where he designed and constructed the original town reservoir and reticulation. He then became engineer to Cornish & Bruce, contractors for the Melbourne to Sandhurst railway, and took charge of the section between Woodend and Castlemaine, the heaviest works on the line. While employed there Brady won the Victorian government's premium of £500 for the best scheme for a water supply to the Bendigo and Mount Alexander goldfields, and he was appointed to survey and design this system now known as the Coliban River water supply.

Brady next visited Queensland, intending to contract for railway construction; instead he contracted to improve navigation on the Brisbane and Bremer Rivers between Brisbane and Ipswich, a task involving much submarine blasting. When this contract was partly completed the Victorian government recommended him as engineer to the Brisbane Board of Water Works. He accepted the position and his river contract was terminated by agreement, with Brady receiving half the contract amount. Although the Queensland *Government Gazette* records only his appointment as engineer of harbours and rivers on 21 January 1865, other sources indicate that he served as engineer to the Board of Water Works, successfully undertaking the Enoggera Water Works, and the design and supervision of construction of the reservoir, gravitational works and reticulation for the city of Brisbane in 1865-67. At the same time he reported on the Bremer River railway bridge and the unsatisfactory progress of the contractor for the Brisbane-Dalby railway. Clearly the Queensland government used this versatile engineer in many capacities.

On 3 August 1867 Brady accepted a government offer to manage the Brisbane-Dalby railway construction, under the direction of the chief engineer, at a salary of £600 with a monthly bonus of £25 if the work cost no more than the original contract. Brady not only earned the bonus but was also given a testimonial and handsome presents by the mayor and citizens of Dalby. An inscribed silver claret jug was, a century later, in the possession of a grandson in Adelaide.

He returned to Victoria in 1869 and took charge for O'Grady, Legatt & Noonan, contractors to the Victorian Railways, for building the first section of the new north-eastern line from Melbourne to Seymour, including the heavy bridge over the Goulburn River. In 1871 Brady was again engineer to the Bendigo waterworks, where he constructed an additional reservoir, large settling ponds and extensions to the town reticulation. Soon after these works were completed in 1873 a government department took over country water supplies and Brady was appointed engineer for the Bendigo district of the Goulburn River Water Supply, under the department's chief engineer, George Gordon.

In 1877 Brady applied successfully for appointment as engineer to the new Melbourne Harbor Trust. He had already left his mark on many civil engineering works of importance, and in this office he gave outstanding service to the commissioners and the colony of Victoria. Not only did he carry out the basic development of the Port of Melbourne but his force of character, experience and sound judgment enabled him to provide convincing argument against very powerful opposition in favour of the developmental scheme provided by the trust's consultants, Sir John Coode & Son. While in no way detracting from the major virtues of the consultants' scheme, Brady's changes saved much expenditure at a time when finance for the new port was difficult, reduced the time of construction by several years at a time when harbour accommodation was inadequate and, what proved of greatest value,

made the port structures more readily adaptable to changing shipping patterns, so that eighty years later modern ships are accommodated at what are still basically his original structures. The changes that had these marked effects were the building of Victoria Dock as one large dock instead of as three small ones and the substitution of durable Australian hardwood for masonry construction. In the fourteen years that Brady served the trust he was responsible for the spending of some £3,500,000 on works of the port, about half of which was on the Coode development. When he resigned in 1891 the Harbor Trust Commission gave him £1500 for valuable service. He engaged in private practice as a consultant and arbitrator until 1894 when he retired from professional pursuits.

Brady had been elected an associate member of the Institution of Civil Engineers, London, on 7 December 1875 and became a full member on 3 December 1878. His papers on 'Geelong and Sandhurst Water Supplies' (1878-79) and 'Early railway construction in New South Wales' (1904-05) were published in the institution's *Proceedings*. He died on 8 July 1908 at his home, Allowah, Staniland Grove, Elsternwick.

At St Mary's Cathedral, Sydney, on 14 February 1854 Brady married Adelaide Sarah, a daughter of Henry Keck governor of Darlinghurst gaol. Of their seven surviving children, the eldest son, Lyndon Francis, was a pioneer in the Western Australia timber business and an early manager of Millar Karri and Jarrah Co; the only daughter to marry was Georgina whose husband, Edward Wardell, was master of the Melbourne Mint.

Appendix 3: Maps

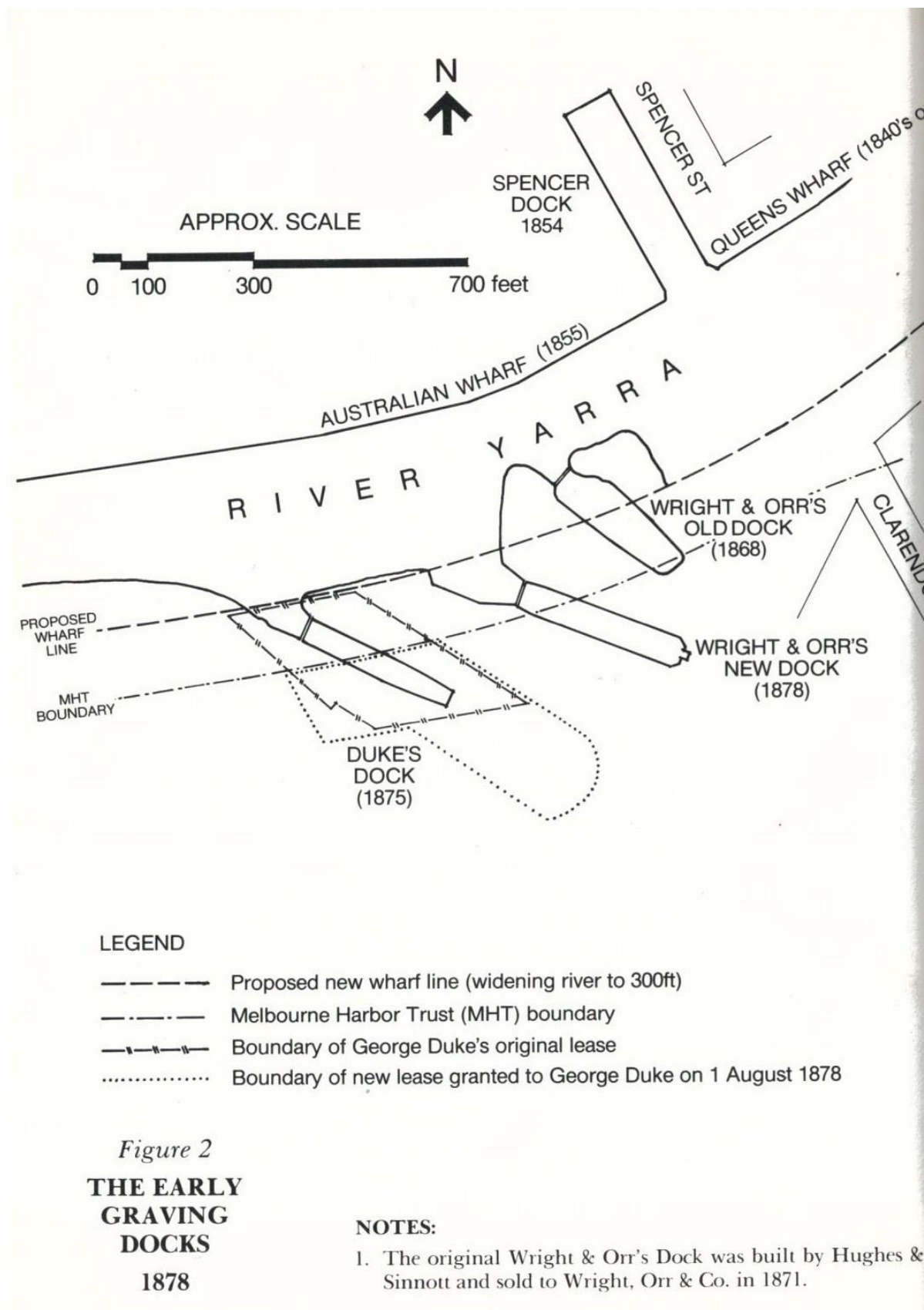
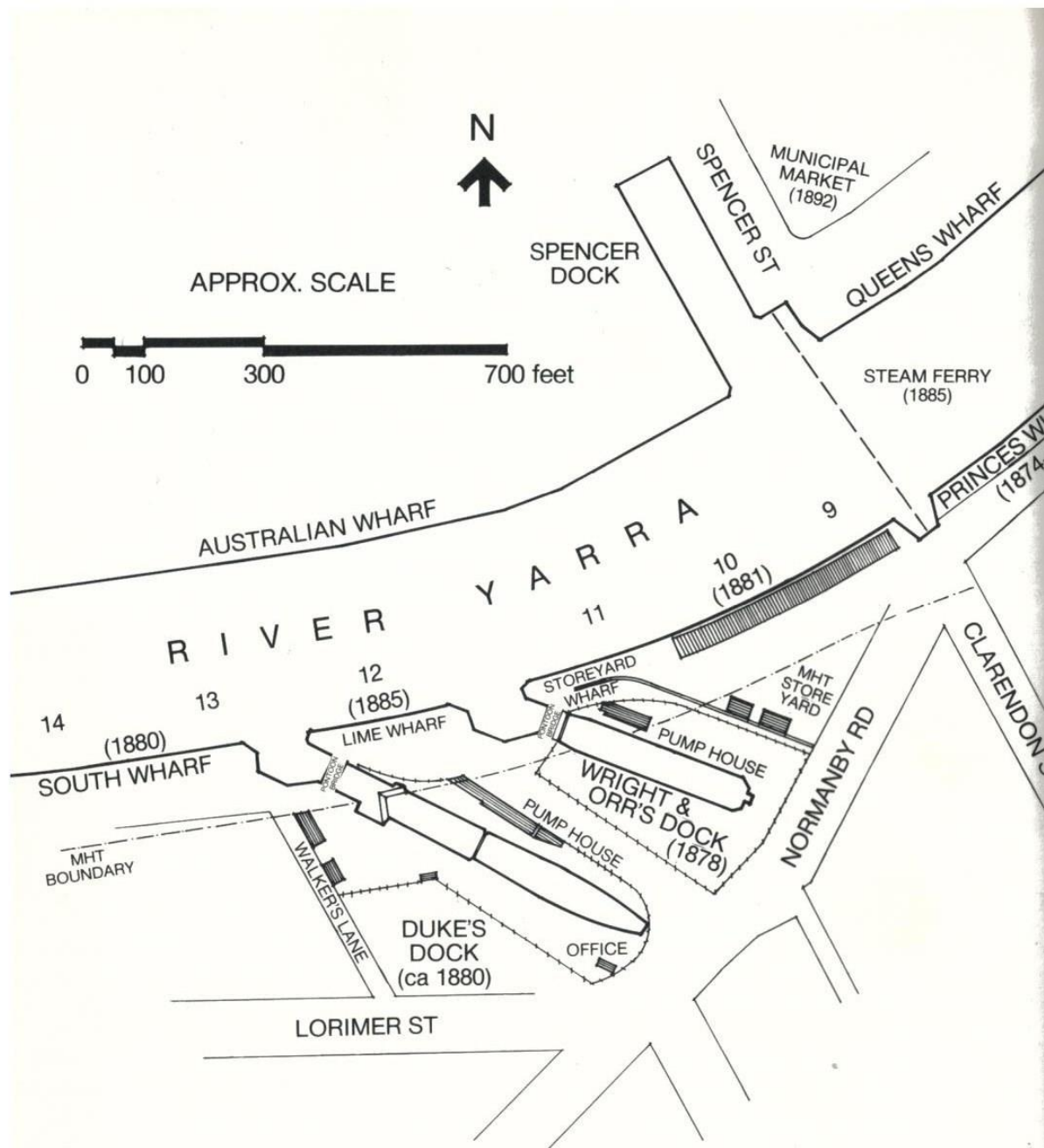


Image: Arthur E Woodley and Bob Botterill, Duke's & Orr's Dry Dock, 1878, page 40.



NOTES:

1. The pontoon bridges were opened at Duke's Dock in 1884 and at Wright & Orr's Dock in 1886.
2. Original berth numbers are shown, together with dates of completion of sections of South Wharf.
3. The original cargo shed at No. 9 Berth was built in 1882 and extended to No. 10 Berth in 1891.
4. Duke's Dock was extended to form a double dock probably about 1879-80. In 1883, the entrance to the outer dock was moved back to the position shown and mitre gates were installed.

Figure 3
THE DOCKS
 and
SOUTH WHARF
 1895

Image: Arthur E Woodley and Bob Botterill, Duke's & Orr's Dry Dock, 1895, page 44.

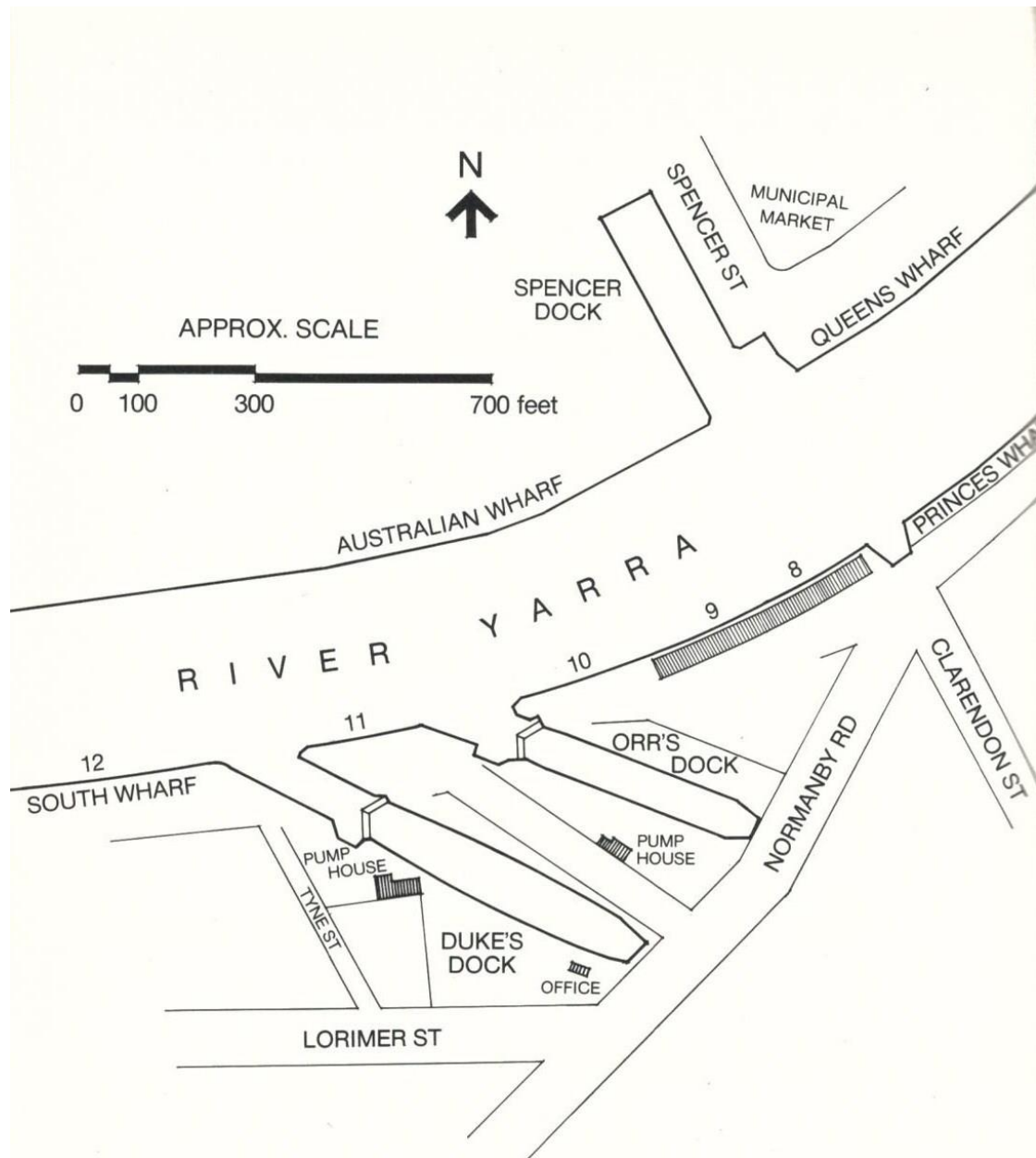


Figure 4
**DUKE'S & ORR'S
 AMALGAMATED
 DRY DOCKS**
 1920

NOTES:

1. Duke's Dock was reconstructed in 1901-04, Wright & Orr's in 1907-09.
2. In 1910 the two docks joined forces as Duke's & Orr's Amalgamated Dry Docks Limited.
3. Pontoon bridges at the entrances to both docks were removed in 1903.
4. Berths on Princes & South Wharf were renumbered in 1915.

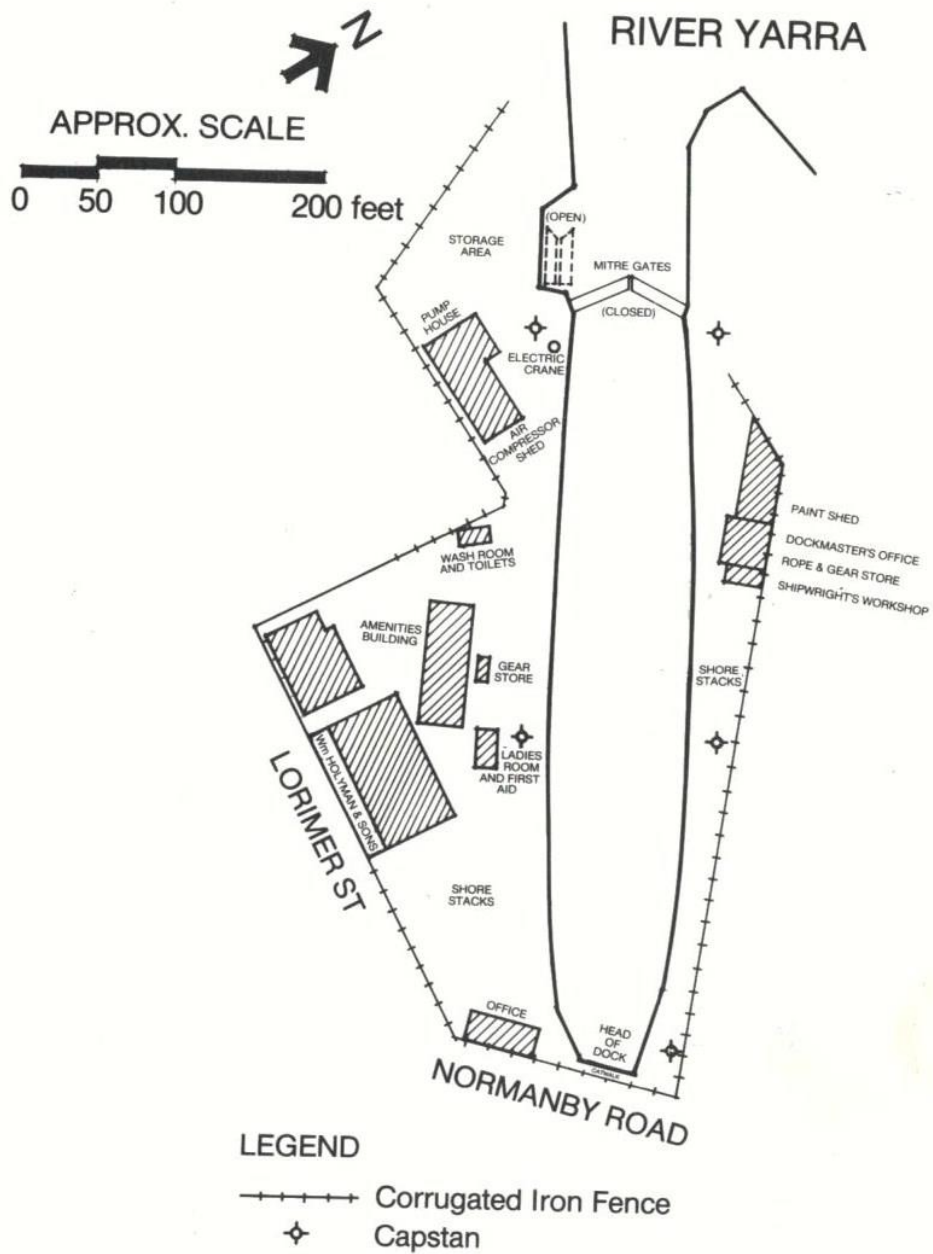


Figure 1
DUKE'S & ORR'S DRY DOCK
 about 1950

Image: Arthur E Woodley and Bob Botterill, Duke's & Orr's Dry Dock, 1950, page 6.

Appendix 4: International Stationary Steam Engine Society Article

This article appeared on pages 42 and 43 of the ISSSES Bulletin Volume 22, No.4 in 2000.

DUKE'S DRY DOCK, MELBOURNE, VICTORIA

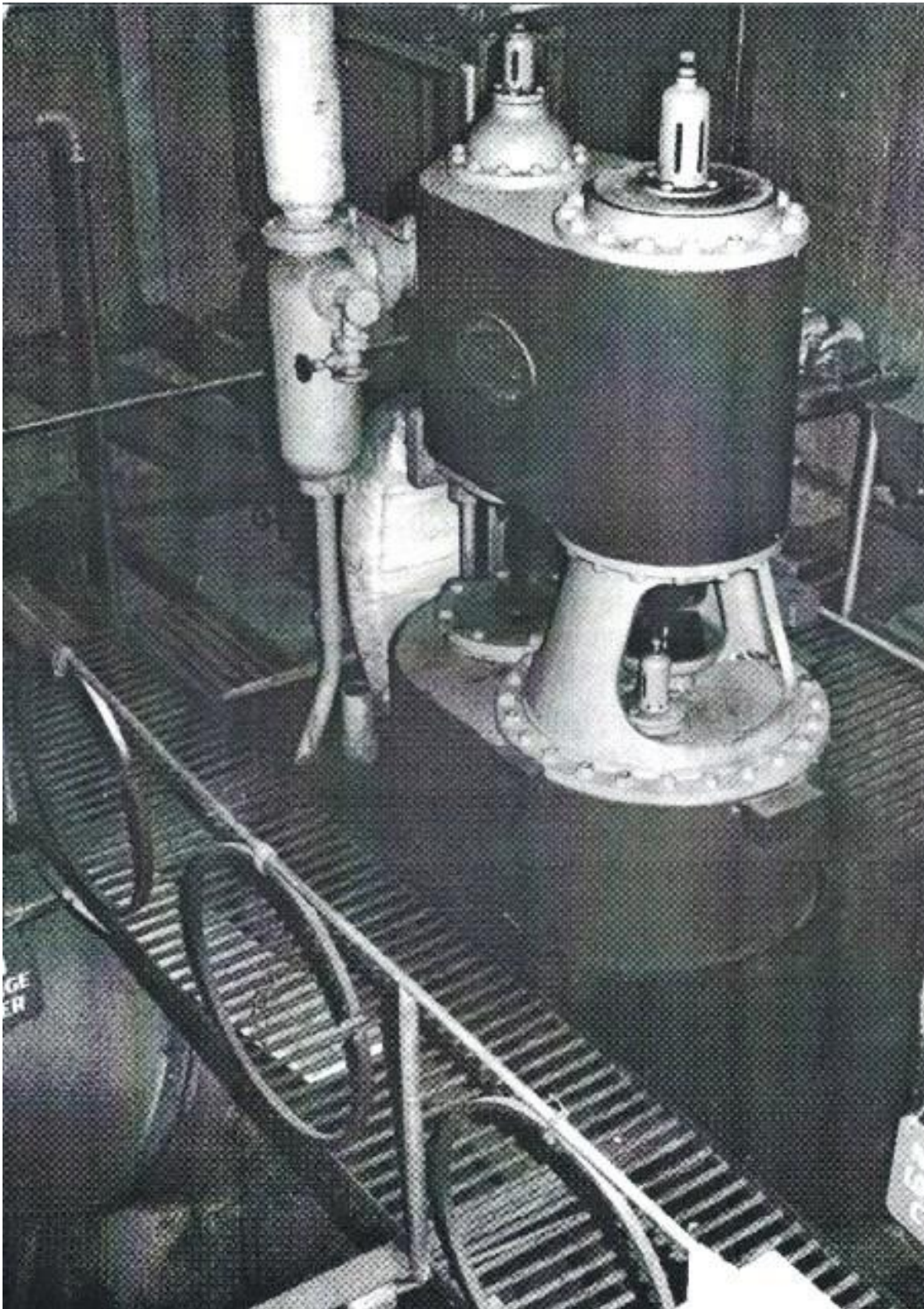
Owen Peake

The dry dock is now the site of the Melbourne Maritime Museum and the dock contains the restored 1885 iron hulled barque *Polly Woodside*. The dock is on the south bank of the Yarra River adjacent to the Melbourne central business district and approximately 7.5 km from the mouth of the river. The pump house and adjoining boiler house for dry dock emptying are located adjacent to the dock entry gate on the western side. Both buildings are corrugated iron clad timber framed structures of simple, functional design. The pump house covers a pit within which the engine and pumps are built.

George Samson Duke came to Australia in 1854 and built the first dry dock on the site in 1868. Duke's Dock was enlarged in 1904, when the present pumping plant was installed. Earlier pumping plant was on the other side of the dock and no longer exists. Ownership of Duke's Dock and another adjacent dock is curious. The records suggest that Duke's company was called G S Duke & Son until 1906, then Duke's Dock & Engineering until an amalgamation with the adjacent Wright, Orr's & Co in 1910 to form Duke & Orr's Amalgamated Dry Docks Ltd. The upgrade of Duke's Dock was carried out in 1904, well before the amalgamation, yet the contract for the pumping engines was with Messrs Wright & Orr who were apparently not involved in Duke's Dock until 1910.

The pumping engine is a twin vertical tandem compound with piston valves. The piston diameters are 12¼" and 21" with a stroke of 14" with the high pressure cylinders located above the low pressure cylinders. Robison & Co, Engineers, Melbourne built the engine for Messrs Wright & Orr. The engine is direct coupled to two 36" centrifugal pumps located at each end of the crankshaft. The two pumps together have a pumping capacity of 90,000 gallons per minute and could empty the dock in one hour. The boiler installation consists of two underfired multitubular boilers, also built by Robison in Melbourne. The rated steam pressure was 190 psi, with firing either by coal or briquettes. The boilers are fitted with a plate which reads "Robison Bros & Co, tested 250 lbs per • ", 1/3/1904, Melbourne". These boilers are no longer serviceable. The dry dock ceased operation in 1975 when the Charles Grimes Bridge was built 500 metres down stream. At this time the dock was dedicated as the permanent home of the *Polly Woodside* and was shortened to accommodate the new Melbourne Exhibition Centre adjacent to the site.

The engine was restored by the Victorian Steam Traction Association.



Duke's Dock pumping Engine built by Robison & Co, Melbourne in 1904 - left hand engine with pump below, looking down from the main pump house floor

Appendix 5: Present Condition Report on the Pump House ⁵¹

1 Summary

The Pump House can generally be described as being substantially complete with its steam pumping engine, close-coupled main centrifugal pumps, boilers and the outline and parts of the fabric of the original building in place.

There are however a number of issues which need attention to preserve the site to the best advantage of future generations.

This report summarises these issues and will be an 'aide memoire' for conservators working on the site.

2 Building

The original timber framed, galvanised iron clad building is in fair condition. Parts of the building have been deliberately stripped away to allow visitors to see within the building from the outside.

During the construction of the Melbourne Convention Centre a new glass and aluminium building was built closely around the old timber framed, galvanised iron clad building. The combination of old and new structure should give the best of both worlds - protection from the environment of the ageing fabric of the old building and a strong sense of the "industrial" nature of the old building.

This objective has been largely achieved however several details need to be attended to as follows:

- Timber within the old building is subject to termite attack. An ongoing program of termite treatment should be implemented to preserve the timber in the old building. This action is urgent.
- The new glass building leaks rather noticeably in several parts of the roof. This is sufficiently bad to fill a bucket in a short time when it rains. This roof should be repaired as a matter of some urgency.
- The new building was not equipped with any form of ventilation, either passive or active. Most of the outside of the building is glass and the building faces north so it receives strong sun particularly during summer. This makes the internal spaces very unpleasant to work in and the sustained elevated internal temperature is likely to favour termite activity. The glass enclosure should be modified to provide permanent ventilation of the interior, possibly supplemented by a fan or fans to facilitate air circulation. It is understood that the Department of State Development, Business and Innovation has plans for such work to be carried out.

⁵¹ This is Version 3 of the document created on 3 Feb 2014 with comments from Miles Pierce and Derek Moore.

- The building is not equipped with a water supply and there are no accessible taps in public places in the vicinity of the Pump House. A single tap within the building, preferably draining to the pump pit would be a great advantage for purposes of regular cleaning, etc.

The present electricity supply in the building and associated electric lighting is satisfactory.

3 Watertightness of the Pump Pit

The Pump Pit has been subject to a number of serious flooding incidents over the last five years with the water reaching a depth of up to about 3 metres.

Water can enter the Pump Pit from three directions:

- From the dock via the pump inlet tunnel and pump suction connections
- From the river via the pump outlet piping. There are four pipes - two main outlet pipes from the main centrifugal pumps and the outlets from the two smaller auxiliary electric pumps
- From seepage into the Pump Pit through its brick walls and concrete floor

Department of State Development, Business and Innovation has had a contractor carry out works to address water entering from the dock via the underfloor tunnel and this appears to have been successful. Plugs have been placed in the inlet piping to the main and auxiliary pumps. Inspection suggests that these are watertight and effective.

Seepage does not appear to be a significant problem. Not much water appears to enter the Pump Pit via seepage and the two existing sump pumps fitted have been able to cope with this minimal infiltration water.

Water entering from the pump outlets is another matter. Continued apparently small quantities of clean water intermittently enter via the west main pump outlet pipe. To date this intermittent inflow has been small enough to drain into the pump pit sump via the 'open' (formerly valved) tapping on the pump suction bend. Again, to date, the existing sump pumps have been able to cope with this occasional inflow, however, if this unexplained inflow increased substantially, they may be insufficient.

The Department of State Development, Business and Innovation has plans to upgrade the existing sump pumps with larger pumping capacity, larger outlet piping and a high level alarm system. This work is considered to be essential and urgent.

The source of the intermittent water inflow to the west main pump evidently via its delivery pipe, is unclear as the configuration of the pipes outside the Pump House is unknown. It presumably comes from the river and appears to be associated with high tides however not necessarily the highest tides. There is some indication that flow occurs in the two hours leading up to a high tide. The inflow water is clear and it cannot be ruled out that all or some of this water is stormwater although, if so, its source is also unknown.

On 21 January 2014, water was inexplicably found in the engine bedplate cavities. Whilst leakage from the west main pump shaft gland was suspected, inspection showed no positive evidence that this was the source of the accumulated water.

Although there does not appear to have been a recent occurrence of backflow from the two auxiliary pump delivery pipes, this remains a possible risk. Such inflow, however initiated, might have been the source of the water that last caused flooding of the pump well when water was reported to have been issuing from the corroded silt box on the east end auxiliary pump. A recent check via the inspection opening in the upper delivery pipe bend for this pump has shown that the non-return valve flap is jammed 'open' and thus could not stop water backflow.

A solution to the risk of backflow via the auxiliary pumps could be implemented by fitting blanking plates between the flanges of the upper pipe bends in the pump well. This has been previously advocated. Blanking of the large delivery pipes of the main pumps would be much more difficult. If attempted, expanding grout plugs, similar to what has been installed on the main pump suction bends might be feasible.

Until the risk of flooding due to remaining unexplained water inflows and possible routes for same is mitigated the bottom half of the steam engine is at risk of further damage. It has already suffered significant damage in recent years with the several flooding events, the last one being of several months duration.

4 Pumping Engine

The bottom end of the engine required considerable cleaning and repair due to having been immersed in river water for long periods as explained above.

Work is required in the following areas:

- Crankshaft and main bearings
- Turning gear
- Flywheel
- Couplings
- Big end bearings and con rod big ends
- Valve eccentrics and eccentric straps
- Crossheads
- Base castings
- Main engine columns

Superficial cleaning and scraping has already been achieved in many areas but this requires several layers of further and more detailed cleaning, scraping and polishing. Most of these parts are bright finish so they have little protection from corrosion. Painted areas require cleaning and repainting.

The top end of the engine is in good condition but requires the following attention:

- Periodic cleaning and application of Inox coating to prevent surface corrosion
- Replacement of some small parts around the cylinders. Some of these parts have been lost whilst others are in storage as they are brass and copper parts at high risk of vandalism. These parts include:
 - Cylinder drain lines
 - Steam lubricators and piping
 - Pressure gauges

- The “blued” steel cladding on the high and low pressure cylinders of the western bank of the engine needs replacement. The upper cylinder (high pressure) has had the surface of the steel cladding damaged by inappropriate cleaning in the distant past. The cladding of the lower (low pressure) cylinder is badly rotted out and requires replacement. Obtaining replacement matching material will be difficult as “blued” steel sheet is no longer commercially available in Australia. The eastern bank cladding is in good condition. Replacement of the cladding should be regarded as routine maintenance as it is a fragile material. Nevertheless Heritage Victoria should be consulted before any work of this nature is planned.
- Plating in the intermediate platform requires some repairs to fixing.
- Plating in the intermediate platform requires repainting.
- The emergency stop valve operating mechanism should be replaced. Parts are largely in storage.
- Some small bore steel piping needs to be located and replaced.
- Nameplates need to be located and replaced or replicated and replaced.

Further work on cleaning and painting the intermediate platform, piping and plate-work is still required although major progress has been made in late 2013 and early 2014.

5 Boilers

The boilers are essentially complete except for some boiler-front fittings.

Some cleaning has been carried out on the lower boiler fronts however further cleaning and some painting is required. Cleaning of the upper part of the boiler fronts above the platform is still required.

6 Other Features

The walkways have generally been cleaned of waste and stored materials.

Most stored materials are now located on top of the boilers and around the western side of the boilers out of sight.

The feed pump (not original) has been cleaned. This pump is not piped up to the Pump House at this time.

The old switchboard (not in service) requires some cleaning up.

The ‘Engineers Office’ required cleaning and organising.

7 Spare Parts and Storage

Considerable quantities of piping is stored on top of the boilers. It is believed that this piping came from the following systems which have now been dismantled:

- Feed Pump (the original location of the Feed Pump is unclear) and feedwater system to boilers including steam supply for the Feed Pump.
- Feed Water Heater connections to the feed system

- Steam Supply to the winch which was located outside the Pump House adjacent to the front wall roughly in the centre of the front wall.
- Steam supply to the air ejectors fitted to the main pumps.

Some other parts known to be part of the Pump House are stored on top of the boilers.

Some parts of the dock gates are stored adjacent to the west side of the west boiler.

Some parts are stored securely in the phone box at the north east corner of the Pump House.

8 Interpretation

There is an urgent need for new interpretation to be installed at the site. Some older interpretation remains but it is faded and inappropriately located or in storage to protect it.

Department of State Development, Business and Innovation has commenced design of new interpretation panels (using a consultant). Engineering Heritage Victoria has offered its expertise in this area. It is hoped that this task can be progressed in 2014.

9 Conservation Management Plan

The Pump House has not been subject of a Conservation Management Plan (CMP). It is now considered urgent to produce a CMP. This primarily requires engineering heritage expertise with particular knowledge of steam machinery to address the machinery in the Pump House with some architectural input as well.

OWEN PEAKE

Chair

Engineering Heritage Victoria

29 January 2014

Appendix 6: Time Line for Key Dates for Yarra River Dry Docks

- 1868 Wright & Orr's Old Dock completed.
- 1871 Hughes sold out to Wright, Orr and Duke.
- 1874 Duke left the partnership to open his own dock and was replaced by Flett.
- 1874 Duke started construction of his dock further south on the river.
- 1875 Duke's Dock completed.
- 1870s Melbourne Harbour Trust starts widening the river and building new wharves.
- 1876 Wright, Orr & Co obtained new lease south of their old dock.
- 1878 Warfare between Melbourne Harbour Trust and dock owners and workers to force the closure of the old dock.
- 1878 Wright, Orr & Co new dock completed.
- 1883 Further dispute between Melbourne Harbour Trust and Duke over the location of his new dock. Duke shortened his dock and obtained compensation from the Harbour Trust.
- 1901 Rebuilding of Duke's Dock commenced.
- 1904 Rebuilding of Duke's Dock completed.
- 1907 Wright, Orr & Co closed their dock to rebuild it.
- 1909 Wright, Orr & Co dock reopened.
- 1923 Yarra flooded causing damage to the floor of Duke's Dock.
- 1925 Plans drawn up to replace the floor and parts of the walls of Duke's Dock with concrete.
- 1932 Wright, Orr & Co Dock closed due to the effects of the Depression.
- 1935 Further blow out of the floor of Duke's Dock, concrete floor fitted as part of the repairs.
- 1936 15 ton electric crane installed at Duke's Dock.
- 1937 The Shell Tanker *Clam* used Duke's Dock (now termed Duke's & Orr's

Dock) demonstrating its capacity to take heavier ships.

1975 Duke's & Orr's Dock closed.

1977 The former Duke's & Orr's Dry Dock was ceded to the National Trust of Australia (Victoria) by the Victorian Government to accommodate the barque *Polly Woodside*.

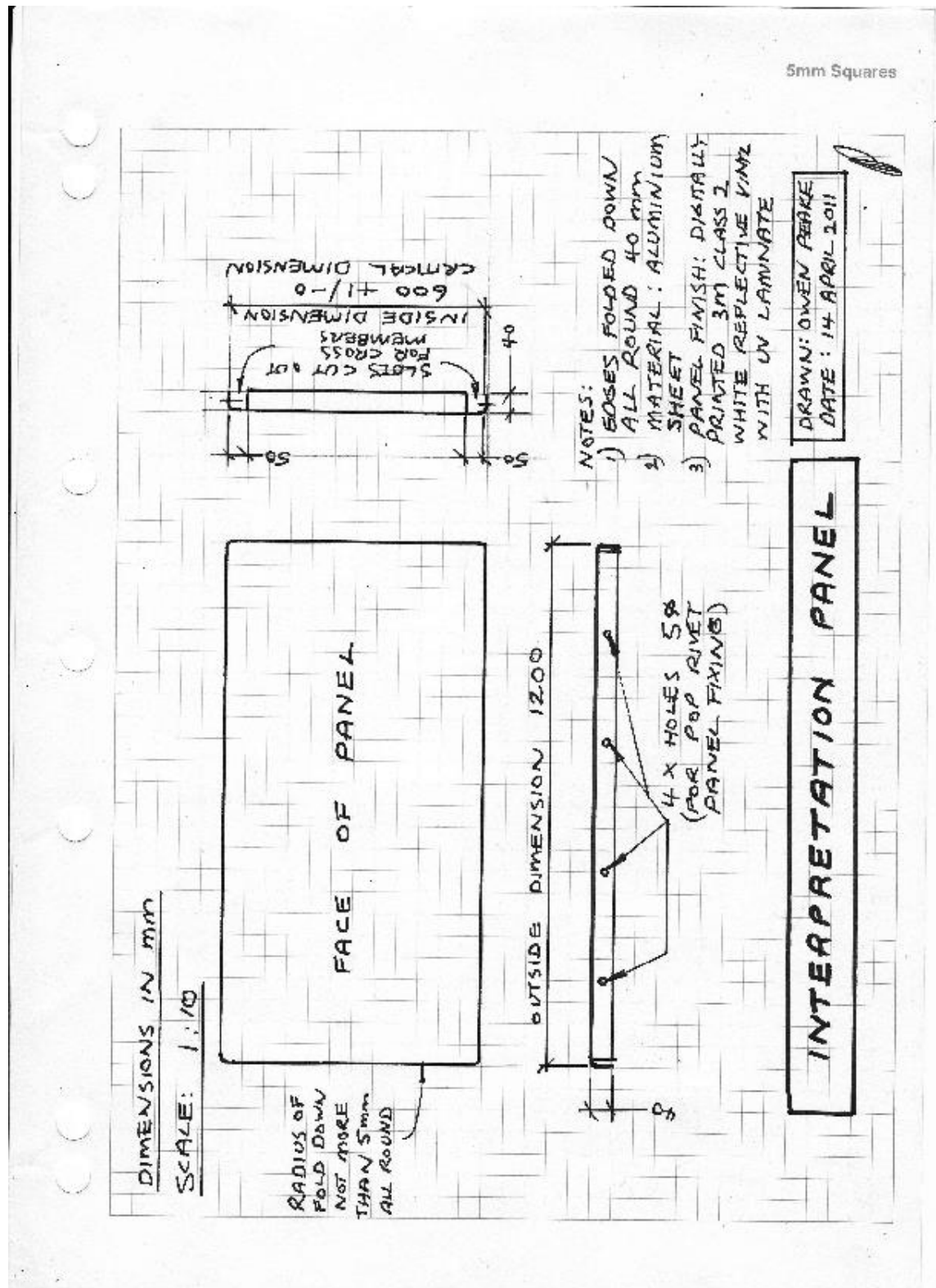
1985 Duke's & Orr's company operates the floating dock *A J Wagglan* further down the river below the Charles Grimes Bridge.

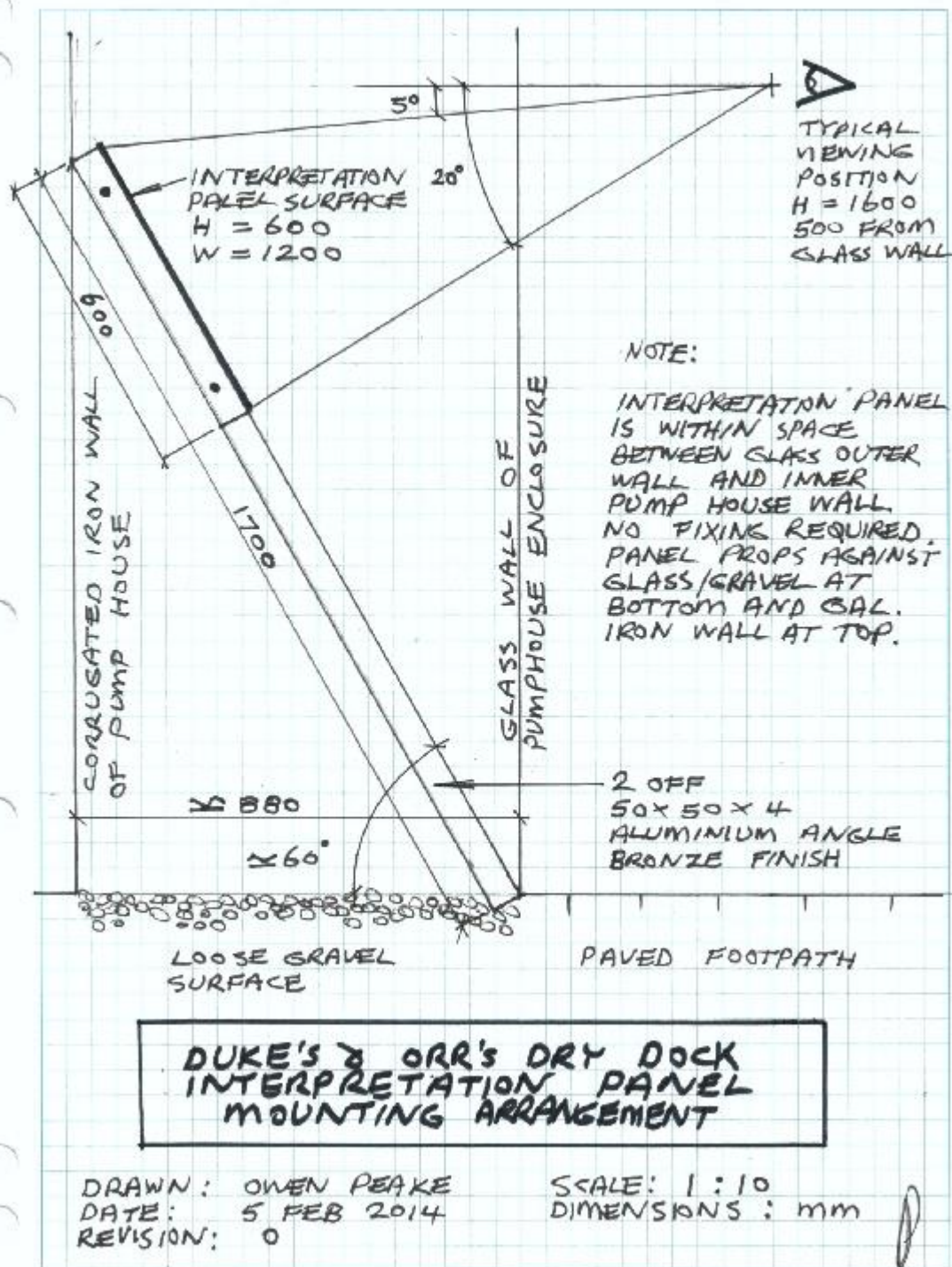
1996 The Melbourne Exhibition Centre (Jeff's Shed) opens. It was built over part of the Duke's & Orr's Dock.

2009 The Melbourne Convention Centre opens including the new enclosure for the Pump House of the Duke's & Orr's Dock.

2009 The remaining section of Duke's & Orr's Dock is refitted to accommodate the *Polly Woodside*.

Appendix 7: Interpretation Panel & Mounting Frame Drawings





Appendix 8: Owners Letter of Approval



Department of State Development, Business and Innovation

121 Exhibition Street
Melbourne Vic 3003
Australia
PO Box 4509
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Australia
Telephone: +61 3 9651 2829

25 August 2014

Mr Owen Peake
Chair
Engineering Heritage Victoria
4 Islington Street
COLLINGWOOD VIC 3066

Dear Mr Peake

DUKE'S and ORR'S DRY DOCK PUMP HOUSE

Owners Consent to Nomination under Engineering Heritage Australia heritage recognition program

I refer to your 5 March 2014 letter regarding recognition under the Engineering Heritage Australia heritage program.

I am the delegated representative of the Maritime and South Wharf Reserves Committee of Management, owner of the Duke's and Orr's dry dock pump house. In this role, I consent to Engineering Heritage Victoria seeking recognition of the Pump House under the national Engineering Heritage Australia heritage recognition program.

I also confirm that the Committee of Management will fund the catering for the formal ceremony should the nomination be successful.

If you have any queries, please contact Glenn Gunther, Director Strategic Projects on 9655 8513.

Yours sincerely

PETER NOBLE

Deputy Secretary, Major Projects

On behalf of the Maritime and South Wharf Reserves Committee of Management



CHANGE CONTROL

VERSION 1	16 JANUARY 2014	5300 WORDS	COMMENCED DRAFTING
VERSION 2	19 JANUARY 2014	6041 WORDS	FURTHER DRAFTING
VERSION 3	26 JANUARY 2014	7489 WORDS	FURTHER DRAFTING
VERSION 4	27 JANUARY 2014	8722 WORDS	FURTHER DRAFTING
VERSION 5	3 FEBRUARY 2014	14365 WORDS	FURTHER DRAFTING
VERSION 6	4 FEBRUARY 2014	16028 WORDS	FURTHER DRAFTING
VERSION 7	21 FEBRUARY 2014	16839 WORDS	EDIT & CHECK
VERSION 8	3 MARCH 2014	17343 WORDS	ADDED COMMENTS FROM MP
VERSION 9	13 MAY 2014	17287 WORDS	MINOR EDITING
VERSION 10	4 JUNE 2014	17286 WORDS	INCORPORATED PROOF READING
VERSION 11	14 SEPT 2014	17361 WORDS	REMOVED REFERENCE TO BODIES IN BOILERS + ADDED OWNERS LETTER OF APPROVAL